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Review of Battle Staff Training Research at Brigade and Battalion Levels

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U.S. Army Research Institute

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This report provides a foundation for future research and development on battle staff training by providing examples of structured training programs for the battle staff. Critical deficiencies in battle staff training were highlighted for both individual and collective skills. Reviews were performed for (1) military articles on how to improve battle staff performance, centering on use of simulations in a structured training program, and (2) research and development programs to improve battle staff training. Also, possible future directions for battle staff training were discussed.

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Research Report 1730

Review of Battle Staff Training Research at Brigade and Battalion Levels

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FOREWORD

The Future Battlefield Conditions Team of the Armored Forces Research Unit, U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), is conducting research and development for work package (2228) FASTRAIN: Force XXI Training Methods and Strategies. These research and development (R&D) efforts leverage simulation to increase training opportunities and reduce unit time required to prepare for training. The focus of these R&D efforts is to develop and demonstrate prototype training and assessment methods to improve performance. Many of the new R&D efforts that are the subject of this report focus on training brigade and battalion staffs.

This report documents current Army challenges in staff training, and ways in which the Army is attempting to meet those challenges. Current training methods as well as innovative strategies under development are discussed here. The intent of this report is to provide the reader with a current view of brigade and battalion staff training.

Several audiences may find this report useful. Army trainers can use the report to gain an understanding of the most recent directions in staff training. Researchers and training developers can also use the results of this report to focus future efforts concerning battle staff training.

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Technical Director

REVIEW OF BATTLE STAFF TRAINING RESEARCH AT BRIGADE AND BATTALION LEVELS

EXECUTIVE SUMMARY

Research Requirement:

The battle staff is a critical factor in unit combat effectiveness. Well-trained individuals, crews, platoons and subordinate units cannot compensate for a poorly trained battle staff. This report documents the current challenges in battle staff training and the Army's attempts to meet these challenges, laying the foundation for future research and development on battle staff training.

Procedure:

This report is divided into four sections. First, material discussing research on battle staff performance at combat training centers (CTCs) is reviewed. Problems in staff performance are documented. Second, military articles pertaining to how to train staffs are reviewed. Third, current research on innovative programs to train battle staffs is discussed. Finally, future research directions in battle staff training are examined.

Findings:

This report provides a foundation for future research and development on battle staff training by providing examples of structured training programs for the battle staff. Critical deficiencies in battle staff training are highlighted for both individual and collective skills. Reviews are performed for (1) military articles on how to improve battle staff performance, centering on use of simulations in a structured training program, and (2) research and development programs to improve battle staff training. The latter programs were designed using structured training principles and increase in difficulty and complexity (crawl, walk, run). Possible future directions in battle staff training are also discussed.

Utilization of Findings:

This report can assist future developers of battle staff training. The report presents the current state of battle staff training at brigade and battalion level. Current and future research and development efforts to improve battle staff training are discussed.

REVIEW OF BATTLE STAFF TRAINING RESEARCH AT BRIGADE AND BATTALION LEVELS

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Introduction

The work of the battle staff is critical to the success of military operations. According to military publications, the major purpose of the staff is to assist the commander in the control of assigned forces (Department of the Army [DA], 1996b). Research literature defines the staff as a decision making team that assists the commander in obtaining situation awareness, making decisions and implementing decisions (McIntyre & Salas, 1995). As such, the role of the staff is unique. Even though individuals, crews, platoons and company/teams are superbly trained, without direction they will have little, if any, effect in an operation. No other element in the unit can compensate for an ineffective staff. An oft-quoted Army aphorism is that a staff cannot win the battle for you, but it can lose it.

This paper will discuss battle staff training at brigade and battalion levels in the U.S. Army today. The paper has four major foci. These include:

- Identifying problems in battle staff performance at combat training centers (CTCs).

- Examining military articles concerning battle staffs and their training.

- Detailing current research on innovative programs to train battle staffs.

- Discussing future research directions in battle staff training.

Battle Staff Performance at Combat Training Centers

Documenting Individual and Collective Staff Deficiencies

Because of the importance of staffs, the Army needs to know whether staffs can properly perform their functions. Thompson, Pleban and Valentine (1994) reviewed five studies documenting performance of battalion level staffs at the Joint Readiness Training Center (JRTC). They found weaknesses by both staff position and overall commander and staff functions. Weaknesses by staff position included personnel (S1), intelligence (S2), operations (S3), logistics (S4), fire support (FSO), engineer, aviation (air liaison officer [ALO]) and air defense (ADO). Weaknesses by overall commander and staff functions included command and control and synchronization.

Thompson et al.'s (1994) data collection efforts examined staff performance of battalion staffs at the JRTC. Observer controllers (OCs) rated battalion staffs on a three point scale ranging from fully trained (T), through needs practice (P) to untrained (U) on ten battle staff mission training plan (MTP) tasks. These tasks, listed in Table 1, involved command and control, personnel, intelligence, logistics, fire support, engineer and combat service support commander and staff functions.

The findings of Thompson et al.'s (1994) research indicated that staffs had considerable difficulty performing MTP tasks at the JRTC. Less than a quarter of the ratings on any of the ten tasks were "T's." On seven of the ten tasks, at least half the OC ratings were "U's." These data reinforced the findings of the five studies reviewed by Thompson et al. in the same report. The findings demonstrated that staffs arrive at CTCs unable to perform important tasks, suggesting pervasive weaknesses in staff training.

Recent trends reported by OCs at CTCs (DA, 1996a; 1997a; 1997b) provided more specific information on staff deficiencies. These trends included problems in battle tracking, which resulted in an unclear picture of the battlefield. Further, staff sections were reported to have difficulties in integrating the information received and disseminating the information to other staff sections. Also, OCs stated that staffs do not consistently analyze the information acquired, thus failing to provide the commander with situation awareness, predictive analyses, and recommendations for future actions. Instead, staffs frequently saw their main role as relaying information to higher headquarters. Thus staffs experienced problems with information management, from obtaining and recording information, through integration and communication to analysis.

The above trends have not been quickly reversed. Nearly identical problems were reported in trends at the National Training Center (NTC) for the fourth quarter, Fiscal Year (FY) 94 through second quarter, FY96 (DA, 1996a) as well as third and fourth quarters FY96 (DA, 1997a). Similar trends were also observed at the JRTC for the fourth quarter FY96 through first quarter FY97 (DA, 1997b).

Reasons for Staff Deficiencies

Survey results from Thompson et al.'s (1994) findings were useful in further illuminating reasons for these problems. The survey data demonstrated inadequacies in both individual and

Table 1

Battle Staff Performance on Selected MTP Tasks at JRTC (Adapted from Thompson, Pleban, & Valentine [1994], pp. 202-204)

Command and Control Task Performance

TASK 600: Develop & Communicate A Plan Based on the Mission (Battalion)

	Trained	Needs Practice	Untrained	Missing	Total
Number	4	4	11	2*	21
Percentage	21	21	58	9	--

TASK 602: Prepare for Combat Operation (Battalion)

	Trained	Needs Practice	Untrained	Missing	Total
Number	3	4	12	0	19
Percentage	15	22	63	0	--

TASK 603: Command and Control Operations

	Trained	Needs Practice	Untrained	Missing	Total
Number	4	2	13	0	19
Percentage	21	11	68	0	--

Primary Battalion Staff Performance

TASK 452: Perform Personnel Actions

	Trained	Needs Practice	Untrained	Missing	Total
Number	0	3	3	4	10
Percentage	0	50	50	40	--

TASK 1100: Establish Priority Intel Requirements & Intel Requirements

	Trained	Needs Practice	Untrained	Missing	Total
Number	1	6	4	11	22
Percentage	9	55	36	50	--

TASK 453: Perform Logistical Support

	Trained	Needs Practice	Untrained	Missing	Total
Number	0	6	0	4	10
Percentage	0	100	0	40	--

Slice Element Performance

TASK 626: Plan, Develop, and Communicate a Tentative and Final Task Force Fire Support Plan (Battalion)

	Trained	Needs Practice	Untrained	Missing	Total
Number	0	9	13	1	23
Percentage	0	41	59	4	--

TASK 627: Prepare Initial Fire Support Plan in Support of Maneuver Plan

	Trained	Needs Practice	Untrained	Missing	Total
Number	0	7	15	0	22
Percentage	0	32	68	0	--

TASK 750: Plan Maneuver/Countermaneuver/Security Operations

	Trained	Needs Practice	Untrained	Missing	Total
Number	1	5	17	0	23
Percentage	4	22	74	0	--

TASK 1025: Develop and Communicate a Combat Service Support Plan

	Trained	Needs Practice	Untrained	Missing	Total
Number	6	15	5	5	31
Percentage	19	58	23	16	--

* Number and percentage of total missing cases not included in TPU% breakdown

collective staff training. Concerning individual training, survey results showed that most officers received training relevant for battalion and brigade level staff positions (i.e., officer advanced courses) only after they had held staff positions. Hence officers had to learn how to perform their staff assignments while working in them in garrison (on-the-job training [OJT]).

There were several problems with learning staff skills through OJT. First, staff duties in garrison had little relationship to staff duties in combat or at a CTC, so simply performing staff garrison duties provided little training for the CTC experience. Second, most staff jobs were quite demanding, leaving little time for individual study. Third, (until recently) few succinct materials teaching staff skills for specific positions were available. Staff members would have to delve through generic materials (such as Staff Organization and Operation, Field Manual [FM] 101-5, DA 1996b) and their references, to piece together how to perform their specific duties. Thus, it was unlikely that OJT would prepare many staff officers for a CTC rotation.

Survey data also suggested deficiencies in collective staff training. Survey results showed that staff members perceived their preparation for a CTC rotation as inadequate only at the end, not the beginning, of the rotation. The authors concluded from this that home station collective staff training such as command post exercises (CPXs), map exercises (MAPEXs), or tactical exercises without troops (TEWTs) seemed to provide training, but when held up to the CTC experience, were found to be inadequate preparation for the Army's capstone training experience.

Perhaps the types of skills stressed in a CPX (e.g., establishing the main command post [CP], performing radio checks) were not the same types of skills most important in staff operations at a CTC (e.g., command and control the task force). Due to the lack of maneuver space in local training areas, units could not conduct "on the ground" command and control (C2) training at home station. A scripted CPX, while perhaps seeming realistic, did not present the challenges of C2 that units encountered at a CTC.

Another problem the authors surfaced was the lack of stability in battle staffs. In the units surveyed, staff members had an average of about 13 months in their position, but less than five months together (commander, executive officer [XO] and S3). Since current staff home station training exercises may only occur annually, many staffs may never have trained as a team prior to a CTC rotation. One aspect of teamwork involves

learning to depend on one another and to back each other up (McIntyre & Salas, 1995). Such behaviors are acquired only after extensive experience. Thus it is likely that many staffs at CTCs were not able to display the teamwork and synchronization necessary to function as an effective staff.

Given this situation, it was likely that many staffs arrived at a CTC lacking both the individual and collective training necessary for success at a CTC. Since the intense, realistic training at a CTC was very demanding and unforgiving of mistakes, one could expect deficiencies in staff performance that would affect the entire unit.

Recommendations for Ameliorating Staff Deficiencies

As a result of these findings, Thompson et al. (1994) recommended changes in both individual and collective staff training. The authors developed and published a Commander's Battle Staff Handbook that outlined the basic functional area duties for each member of the battalion task force staff (Pleban, Thompson, & Valentine, 1993). The authors recommended development of computer based training (CBT) to instruct individual staff members in skills and knowledge necessary for them to perform their tasks. Also, the authors recommended constructive and virtual simulations to provide regular collective training for staffs.

Empirical research concerning the training of various tactical decision making (TDM) teams has also been performed. A detailed review of this research, involving military and civilian air crews, Navy fire support teams, Navy combat information center (CIC) personnel and Army staffs, is presented in Appendix B. More detailed reviews of the relationship between TDM team processes and staff performance are provided in Appendix C.

Theoretical Articles on Battle Staff Training

Several military authors have recognized the importance of battle staffs and their training deficiencies. These authors typically based their comments on observations at CTCs. They also offered proposals on how these deficiencies can be corrected.

Colonel John Rosenberger (1995; 1996) identified deficiencies in battle staff performance based on experience as a senior OC at the NTC. He cited the historically poor record of units against the opposing force (OPFOR) at the NTC. Rosenberger attributed the failure to defeat the OPFOR primarily to a lack of synchronization, or failure to apply the capabilities of the combined arms team against the OPFOR at the right place and time.

According to Rosenberger (1995), the causes of this lack of synchronization were deficits in both individual and collective staff skills. Rosenberger stated: "As an Army, we have not identified the individual and team tasks every staff officer must perform during the planning, preparation and execution of operations" (1995, p 14). He expounded on this statement by indicating that "the current MTPs, Army Training and Evaluation Program (ARTEP) MTP 71-2 [DA, 1988a] and ARTEP MTP 71-3 [DA, 1988b] (battalion and brigade Army Training and Evaluation Plans) are completely inadequate" (1995, p 15). If one has not identified the tasks, then it follows that they cannot be intentionally trained.

Although Rosenberger (1995) does not use the term, an important reason why commanders and staffs cannot synchronize combat power was because they have not been trained to form "mental models" of the battlefield. According to Rosenberger, commanders and staffs could not "see" (visualize) the terrain, the enemy or themselves. By seeing the terrain, he meant that they could not conceptualize how the terrain would affect the operation. They could not see the enemy in the sense that they could not imagine how the enemy commander would fight the battle, so they could not know what they must do to plan inside the OPFOR decision cycle. Commanders and staffs could not see themselves in the sense in that they did not understand the capabilities and limitations of their own assets, and how these capabilities and limitations affected the operation. Also, the commander and staff failed to appreciate how the OPFOR "saw" them and expected them to operate.

Finally, Rosenberger (1995) stated that commanders did not effectively state their intent. He contended that commanders must state their intent in terms of effects they intend the force to achieve and use clearly understood doctrinal terms.

Rosenberger's (1995) articles also discussed solutions to the problems raised. He stated that one must first identify the critical individual and collective staff tasks, train the tasks in the branch schools and sustain the skills in the field. He further stated the only way to sustain staff skills was through simulations, built around a concept of structured versus free play training. This direction is discussed in more detail later in this paper.

Rosenberger (1995) ended his article on an ominous note. He stated that if we cannot develop sufficient synchronization with known equipment to defeat an enemy using known force structure and known tactics, how can we hope to operate successfully in the future? The future will be digital, with many new information systems which staffs will need to understand how to use (not just

operate). Also in operations other than war, the enemy, enemy structure and tactics are all potential unknowns. Rosenberger states "In an era of potential conflict against information, industrial, or agrarian opponents, whose doctrine and tactics are far less predictable, what then? The difficulties of synchronizing the combined arms team under these conditions jumps an order of magnitude" (1995, p. 20).

Another military writer who has recently examined battle staff training and its deficiencies is Lieutenant Colonel (LTC) John Antal. Unlike Rosenberger, whose focus is on synchronization of combat power, Antal (1995) concentrated on problems in the tactical decision making process as a major shortfall of battle staffs. Antal stated that a major weakness of battle staffs is rapid decision making. He indicated that the future battlefield would require increasingly rapid decision making and a speedy decision cycle. Antal stated that current training, both in the schoolhouse and at the CTCs, emphasizes extensive planning and preparation, resulting in a detailed operations order, at the expense of a quick decision cycle.

Antal (1995) outlined a strategy to train the battle staff in rapid decision making. He stated that basic staff processes may be trained through a series of tactical discussions, staff rides, war games, and maneuvers. Tactical discussions are detailed tactical analyses of historical battles. Staff rides are similar to tactical terrain walks or TEWTS. They may involve going over the ground of historical battles or potential future operations. War games are board games, map exercises, sand table exercises, simple computer games and similar training designed to train staff decision making. Maneuvers are large-scale exercises, generally involving troops. Exercises at the CTCs are the best examples of this type of training. However, Antal indicated that effective training for the staff can now also be performed using the right mix of live, constructive and virtual simulations. This training strategy, using progressively more complex training (crawl, walk, run), is similar to the research and development strategy described later in this report.

To achieve a rapid decision making cycle, Antal (1995) stated, the staff must train frequently against a live, thinking opponent in real time. Antal suggested that commercially available board games or simple computer games can serve this purpose if sophisticated simulations are not available. The key, according to Antal, is competition with a live opponent in real time. This training will force staffs to adopt, refine and perfect a rapid decision cycle.

LTC Douglas Macgregor also examined how changes in technology will, or should, impact on future military operations.

Macgregor (1995) posited two major changes in technology that can affect future combat. One of these changes is improved weapons capability in the areas of range, precision and lethality. The other is the improvement in information technology. Macgregor contended, however, that neither trend would result in improved combat effectiveness unless our methods of operation are changed to incorporate these improved weapon and information capabilities.

Macgregor (1995) criticized certain aspects of current Army tactics at battalion and brigade levels. He stated that prepared defenses, massing troops for fires, and centralized command and control need to give way to mobility, using dispersed assets to mass fires (not forces), and initiative of subordinates. Instead of conducting frontal assaults, Macgregor recommended that tactics need to stress use of rocket artillery with air assault, using armor units to attack the enemy flanks and rear. He stated that these tactics will take advantage of the technological improvements in weapon and information systems.

Macgregor (1995) also echoed Antal's (1995) call to train the staff for rapid adaptation to changes in plans during mission execution. He stated that in order to take full advantage of information technologies, command and control must be decentralized. He proposed that instead of emphasizing laborious, detailed planning and preparation, training needs to teach simple, quick planning and preparation, and the ability to quickly change plans to exploit emerging opportunities during mission execution. "In the world of Force XXI, the task force commander must exercise judgment as part of the cognitive planning process and reclaim responsibility for decision making that has been increasingly absorbed by battalion and brigade staffs" (Macgregor, 1995, p. 11).

The latter quote perhaps indicates a difference between Antal (1995) and Macgregor's (1995) thinking. Antal clearly recommended training the entire primary staff in rapid decision making. Macgregor seemed to emphasize the role of the commander in rapid decision making, implying that often the staff must be by-passed to react quickly to changes in the tactical situation. In this view, perhaps, the staff is part of the problem, not the solution.

Lieutenant General (Retired) Frederic Brown, also has recognized problem areas in commander and staff performance and training for the future battlefield. In conjunction with ARI, Brown (1992) has made detailed recommendations for developing a battle staff training program to address problems in battle staff performance observed at the CTCs. The three military writers already discussed have generic proposals to enhance staff

synchronization and rapid decision making. Brown, however, delved into the details of how to train commanders and staffs.

Brown (1992) proposed simulation based training designed to ameliorate the deficiencies in battle staff performance. He started with the premise that simulation allows for training opportunities impossible with field training. Simulations allow recording of performance for use in after action reviews (AARs) and cost effective multiple runs of the same exercise (or even parts of the exercise).

He recommended a staff training program built around the AAR. "The AAR is the critical training event. Design the context, preparation and the training event itself (table and module) to support AAR training" (Brown, 1992, p. S-2). Figure 1 provides an example of a training event built around the AAR, in accordance with Brown's concept. First, one must select the tasks on which one wants the staff to train. With these tasks come conditions and standards, from which one can develop measures of performance (MOP) or measures of effectiveness (MOE). For example, a task might be to perform combat service support operations. The conditions would be that the task force has a fully equipped forward support battalion for coordination. A standard might be that all non-operational combat vehicles are evacuated from the battlefield within two hours of damage. The MOP would be the percentage of combat vehicles evacuated within two hours of damage.

Exercises, to be conducted in simulation, involving structured missions are then developed around the AAR. Since the missions are pre-determined, units can be provided with orders, graphics and other materials. These orders, graphics and materials represent "a way" of executing the mission (e.g., the method used by a highly competent unit to achieve the objective). As part of the AAR, staffs can be shown a preview (demonstration) of a highly competent unit demonstrating "a way" of executing the mission. A comparison is then made between "a way" of executing the mission and "your way" (i.e., the training unit's way) of executing the mission. Thus training emphasizes mission execution versus planning and preparation. The exercise presents cues that elicit behavior from the staff relevant to the MOPs. For instance, the S4 is informed of battle damaged vehicles. This cue should stimulate performance for the MOP "percentage of damaged vehicles removed within two hours of damage."

Individual training exercises are then grouped into tables. A table is a group of exercises designed to train a certain audience to a certain level of task complexity. For instance, tables should be developed for individual staff sections, small

TASK
Evacuate battle damaged vehicles from battlefield
CONDITION
Fully equipped Forward Support Battalion (FSB)
STANDARD
All battle damaged vehicles removed within two hours of damage

Measure of Performance
Percentage of battle damaged vehicles removed within two hours of damage

AAR
- MOP achieved compared to unit standard
- If standard not met, OC discusses S4 behavior contributing to shortfall

Cue
S4 notified of battle damaged vehicles and location within X minutes of damage

Staff Behavior
(Observed by OC)
- Does S4 notify FSB?
- How soon?
- Accurate location of damaged vehicles reported?

Interactor Behavior
- If/when notified and given accurate locations "removes" battle damaged vehicle within Y minutes of notification

Automated Data Collection
Records if/when battle damaged vehicles removed

Figure 1. Training Built Around AAR.

groups and the entire staff. Tables should increase in difficulty, from "crawl" to "walk" to "run." This design enables both repetition of the identical mission for staffs performing poorly, and growth for those performing well on the first iteration. Some tables should involve execution, while others should focus on planning, preparation and execution.

Observer controllers are also needed for this training. While automated data collection can provide MOE, it cannot explain why performance concerning an MOE was successful or not. For instance, was failure to accomplish a certain action due to a staff section that did not correctly interpret the information received, did not coordinate with other staff sections, or some other reason? Only a human observer, familiar with staff procedures, can supply that feedback.

As the name implies, the OCs have two roles. First, during training they must control training. If necessary, they provide direction or input to ensure the tasks that the staff should receive feedback on in the AAR are actually trained. Second, OCs observe training in order to provide feedback for the AAR.

Two types of training personnel are needed to provide the AAR. After having observed and guided staff training, one type of OC reviews performance on the MOPs and MOEs with the staff, while other personnel trained in organizational effectiveness (OEs) review staff processes, using Olmstead's (1992) model.

Brown (1992) recommended that this training take place both in institutions (branch schools) and in units. Institutional training would primarily be at the staff section level, whereas home station training might be at any level (e.g., training of a newly assigned staff officer to training of the entire staff). Regardless of whether training for units is centralized or at home station, units must prepare at home station to perform the tables.

Training Support Packages (TSPs)

In order to conduct structured training, TSPs must be developed. These TSPs include all the materials necessary for both OCs and the staff in order to conduct the training. According to the Training and Doctrine Command (TRADOC) Regulation 350-70 (DA, 1995), a TSP includes five categories of materials: unit preparation materials, simulation materials, tactical materials, administrative data, and trainer materials. Unit preparation materials include a description of the training sequence, training objectives, training and evaluation outline, MOP/MOEs, a description of the target audience and a description of the equipment package necessary to perform the training. Simulation materials include a description of the duration of training, unit start of exercise (STARTEX) status, and training aids, devices, simulators and simulations (TADSS) requirements. Tactical materials include scenarios, execution matrix, operation orders (OPORDs), maps and overlays, and a "road to war." Administrative data include direct support required, personnel support required, communications and other equipment (other than TADSS) support required. Trainer materials include OC support packages, tables, exercises and drills, OPFOR support packages, train-the-trainer guides, exercise directive support materials, rules of engagement, standard operating procedures, AAR frameworks and take home package (THP) construction guides. For a more thorough review of Army training development doctrine, see TRADOC Regulation 350-70 (DA, 1995).

Current Research and Development in Battle Staff Training

The Army is conducting research and development (R&D) in innovative training for battle staffs. Some of these R&D efforts involve training in staff reasoning, and others involve training in the entire gamut of tasks and processes that staffs must perform. The R&D in staff reasoning skills will be discussed first, followed by R&D in a variety of individual and collective staff tasks and processes.

Training in Critical Thinking

The Fort Leavenworth Research Unit of ARI is conducting research to develop and refine a course in practical thinking for field grade officers who may serve as battle staff members of battalion, brigade and division staffs (Fallesen, Michel, Lussier & Pounds, 1996). This course focuses on improving performance in tactical decision making.

The current decision making process, as outlined in Staff Organization and Operations (FM 101-5, DA, 1996b) involves developing several alternative courses of action (COA), independently evaluating each COA, comparing the outcomes and choosing one COA. The process starts with mission analysis, which involves identifying the tasks to be performed based on the mission assigned by higher headquarters, the purpose of performing those tasks, and any constraints on the unit's actions. Based on the mission analysis, the restated mission, which includes tasks to be accomplished and the purposes of those tasks (i.e., the commander's intent), is issued. Planning guidance is then issued to the staff. Planning guidance consists of any factors the commander wants the staff to specifically consider in preparation of staff estimates (e.g., avoiding a piece of terrain). Each staff section then prepares a staff estimate, which is a recommendation to the commander on how to accomplish the mission. These estimates must be coordinated among staff sections, and COAs developed. The COAs are then war gamed. This involves forecasting probable enemy responses to each COA, and potential reactions to the enemy responses. Results of each COA are then compared on key factors (e.g., use of terrain) and a single COA is chosen. Based on the COA, orders are prepared, approved, issued, rehearsed and executed.

Research suggested that the current tactical decision making process (TDMP) could be improved. Fallesen et al. (1996) detailed several potential shortcomings of the current TDMP. The process assumes that all good options are readily identifiable. The process does not recognize the amount of uncertainty present in real tactical decision making (e.g., it assumes COAs can be precisely evaluated). The process assumes that there is one best

answer, versus a variety of possible solutions. Perhaps most importantly, the authors stated that process does not reflect how most people think. If people develop several possible solutions at all, they are more likely to choose elements from among the solutions than to choose one intact.

The Leavenworth Research Unit of ARI has recently developed a course in practical thinking to address the shortcomings in tactical decision making. A trial version of the course was implemented as part of the Battle Command curriculum of Command and General Staff College (CGSC), but is not presently being offered. The course consisted of 12 hours of instruction presented in six blocks. These blocks consisted of:

- A course overview
- Instruction in multiple perspectives
- Adapting to the situation
- Finding hidden assumptions
- Developing practical reasoning
- Developing integrative thinking

The multiple perspectives block involved looking at a situation from more than one frame of reference, or "thinking outside the box." Examples of a lack of multiple perspectives given by Fallesen et al. (1996) were the French Maginot Line and the U.S Navy's behavior prior to Pearl Harbor. The French could not conceive of any defense beyond a static, fixed point defense and believed that if Germany attacked, it would attack directly from German soil. The U.S. Navy could not believe that Japan would really attack the Pacific Fleet.

The multiple perspectives block of instruction covered conditions fostering a narrow perspective. One such condition was called groupthink (Janis & Mann, 1977). Groupthink occurs when people focus in on only one alternative, even though there is ample evidence that the alternative is not particularly good. A commonly used example is the Bay of Pigs disaster. Janis and Mann stated that there are four antecedent conditions for groupthink. One is high group cohesiveness (so that individuals do not want to pose ideas antagonistic to supposed group opinion). A second is insulation of the group from ideas or criticism outside of the group. A third is directive leadership, which was generally viewed as being in favor of the group's current opinion. The fourth antecedent is high stress, with a low degree of hope of finding a better solution. All these factors mitigate against other alternatives being considered.

The multiple perspectives block of instruction also presented how to identify narrow perspective. The developers posited that one symptom of groupthink, leading to a narrow

perspective, was selective bias in processing of information. An example of this symptom was failure to give adequate consideration to any information that ran counter to a currently favored alternative.

The block of instruction covering multiple perspectives also presented techniques, guidelines and attitudes to foster taking multiple perspectives, as well as a practical exercise. An example of a technique to foster multiple perspectives given by the authors was reversal. Fallesen et al. (1996) used the example of thinking about how to increase fratricides to provide insights into how to reduce them.

The third block of instruction on adapting to situations provided insights on thinking about how to think, or metacognition. Staff members not only need to decide, but also determine if, what, when and how to decide. This block of instruction provided techniques for adapting one's thinking to situations and guidelines on when to use them. One technique given by the authors for determining if and what to decide was called FITE. It involved judging how Familiar one is with the situation, the Importance of the outcome, the Time available and the Effort required to solve the problem. Obviously, different combinations of answers to these questions determine whether the individual decides, seeks help in deciding, relegates the decision to someone else or dismisses the issue altogether.

The fourth block of instruction concerned hidden assumptions. Assumptions could easily be present in our decision making as beliefs for which there is no evidence. This block of instruction presented techniques for finding hidden assumptions and handling unexpected events (e.g., information disconfirming a current assessment). Fallesen et al. (1996) discussed one technique for finding hidden assumptions. First the officer identified a course of action he or she was certain would be taken. An example the authors gave was that the enemy would cross a river at the only available bridge. Then one imagined a crystal ball that states this COA was wrong. One then identified reasons why the COA was wrong. Some reasons might be that as the enemy has bridging assets we are not aware of, there are places that the enemy could ford the river, or the enemy does not intend to cross the river. After each reason, the crystal ball told the officer that particular reason is not correct, until the officer had identified all the reasons that could be thought of. These reasons were the hidden assumptions. Each hidden assumption was evaluated, and, if necessary, information to confirm or discomfirm was sought. If any of the reasons uncovered seemed valid, the original COA might have been modified.

The fifth block of instruction on practical reasoning involved methods to avoid reasoning errors. This instruction discussed characteristics of practical reasoning, standards of reasoning, avoiding reasoning errors and fallacies, psychological and attitudinal pitfalls, and guidelines for practical reasoning. Standards for practical reasoning given by the authors were fairness, relevance, evidence, clarity and consistency. An example of irrelevant reasoning given by the authors was assuming an enemy would use chemical munitions in a withdrawal because they used smoke aggressively in the attack. The authors covered numerous reasoning fallacies. One example given was reasoning from lack of knowledge. That is, just because there were no reports of enemy activity in an area does not mean that there were no enemy in the area. Perhaps there has been no reconnaissance or intelligence gathering in the area.

The sixth block of instruction on integrative thinking involved understanding the relationships among events or objects that are not obvious to the inexperienced observer. One example given by the authors was that an expert may look at a terrain map and intuitively choose a good avenue of approach without conscious thought, whereas a novice might spend considerable time and effort on this problem. This block of instruction discussed ways to improve integrative thinking, shortcomings of experts and levels of integrative thinking. Examples given concerning how to develop integrative thinking included resolving uncertainties (e.g., gaining deeper knowledge of subject matter), looking before you leap and practicing patience.

<u>Assessment of Critical Thinking</u>

Subjective assessments of the practical thinking course were basically positive. Student ratings showed an improvement in practical thinking skills in all five content areas. Also, 80% stated that the course should be included in the CGSC curriculum. Besides CGSC, other places suggested for the course were service academies, Army War College, School of Advanced Military Studies and officer basic courses. A 20 hour version of the course, using nine sessions has been proposed for CGSC.

An empirical assessment of part of the practical thinking training was recently performed by Cohen, Freeman, Fallesen, Marvin and Bresnick (1996). This research concentrated on critical thinking skills. Critical thinking involved determining sources of uncertainty in a situation. Uncertainty can come from incomplete information, hidden (and perhaps unreliable) assumptions or conflicting information.

Each of these aspects of uncertainty could be addressed by a variant on the crystal ball technique discussed earlier. For

identifying incomplete information the crystal ball repeatedly asks: There is a critical piece of information about this situation missing; what is it? To assess unreliable (or hidden) assumptions the crystal ball repeatedly states: Your assumption that x will (or will not) happen is wrong; why? To resolve conflicting information the crystal ball repeats: Even with the conflicting information, the assumption that x will (or will not) happen is still true; why?

The answers generated in response to the crystal ball help to reduce uncertainty. The information gaps identified reveal areas in which more intelligence is needed. Concerning hidden assumptions, the reasons given for why x will not (or will) happen must be assessed. If any are deemed reasonable, data must be gathered to check these hypotheses or the current plan and interpretation of the situation may have to be changed. Concerning conflicting information, the reasons for why x still will (or will not) occur must be assessed. If all are disconfirmed or rejected as unreasonable, the current plan or interpretation may have to be changed.

Critical thinking skills are especially useful under certain conditions. Critical thinking should be used when time is available, the consequences are serious and the situation is novel or unfamiliar.

The value of critical thinking was evaluated by research with U.S. Army officers. One group of the officers received 90 minutes of critical thinking training. Another group of the officers, who served as controls received 90 minutes of pseudo training. Both trained and untrained officers were given a pre-test and post test.

Officers were given 14 problems overall, counter-balanced for order. Each problem consisted of two parts. On the first part, they were given information concerning a particular scenario and a situation assessment. Then they were provided with additional information. Some of this additional information was neutral, some was consistent with the assessment and some conflicted with it. After each part of the problem, the officers were asked to write an evaluation of the assessment and then indicate agreement or disagreement on a five point scale.

Results tended to support the value of the training. Trained officers generated significantly more disconfirming arguments and significantly fewer neutral arguments on the post test than did the controls. Also, the trained officers' agreement ratings were significantly closer than the untrained officers' ratings were to those of subject matter experts (i.e., more accurate) on two problems. There were no significant

accuracy differences on any other problems. Ratings of training (taken in the experimental group only) were generally positive, with only two participants stating that they would not apply the training in the field.

Freeman, Cohen, Serfaty, Bresnick and Thompson (1998) attempted to apply critical thinking training to battalion level staff officers. The critical thinking training outlined above was adapted using examples relevant to battalion level staff. The acronym for this training was IDEA; Identifying gaps in information, De-conflicting arguments, Evaluating hidden assumptions and taking Action (i.e., recommendations based on the above analyses, including recommendations for gathering more information in a certain area). Training was also presented in when to use critical thinking (basically when stakes are high, enough time is available and the situation is unfamiliar). Another feature added was that personnel receiving critical thinking training also received periodic message updates from the commander telling them what information he needed. A computer interface was designed to both promote use of the training and help provide feedback on its effectiveness. After receiving the training (or pseudo training, for controls), personnel acted as the S3 in an armor battalion during a defense in sector. Participants received messages over a computer interface. Periodically, they responded to a request for information or a request for a recommendation from the battalion commander, based on the message stream just received. Trained participants responded using software designed to prod their use of critical thinking techniques, while untrained personnel respond in free text.

Initial results suggested that the training was effective. With a sample of only 11 (seven in the experimental group) the statistical power was very small, so results could only be viewed as trends. Nonetheless, performance of the experimental group was better in several areas.

Trained participants tended to make more accurate conclusions. For instance, concerning the commander's query about enemy echelon that the battalion was currently facing, the actual "ground truth" (based on a Janus run) was that they were currently facing the forward security element. Reasonable analysis of the message traffic would have revealed that. Participants' answers were rated by a subject matter expert (SME) blind to the participant's condition. Participants were given one point for each correct answer and zero points for any other answer. Trained participants received higher scores.

Trained participants also made stronger arguments. In addition to reaching a conclusion concerning each question from

the commander, participants were told to support the conclusion. Again, ratings by a blind SME showed that trained participants were rated as making stronger arguments.

Trained participants had better quality arguments. The blind SME identified the number of statements in each argument that fell into the categories of supporting evidence, conflicting evidence, deconflicting evidence, identified gaps, hidden assumptions and recommended actions. Trained participants averaged more statements in all categories except recommended actions, but the effects were particularly strong for supporting evidence and identified gaps.

Furthermore, trained participants also tended to process information differently than did untrained participants. They were more egalitarian in ratings of message importance versus rating message importance based on the message source. They tended to compress information (i.e., lower message output to input ratio). Trained participants had more of a tendency to communicate processed information (i.e., created messages) versus just forwarding messages. Finally, they tended to push information not specifically requested versus just respond to queries. This latter finding suggests that the commander's updates were effective in communicating the type of information the commander wanted.

Introduction to ARI Research on Structured Staff Training

The Army is attempting to correct the current deficiencies in battle staff training and performance. The ARI is executing the Force XXI Training Program (FXXITP) in order to develop methods to provide better staff training. Research and development efforts performed to date include a project to identify critical battle staff functions and tasks for training (Battlefield Functions [BFs]). Another effort involved developing training for individual staff members (Battle Staff Training System [BSTS]). A third provided training for staff sections and small groups (Staff Group Trainer [SGT]). Other programs have been developed to train the entire battalion or brigade staff on mission execution tasks (Simulation-Based Multiechelon Training Program for Armor Units [SIMUTA], Simulation-Based Mounted Brigade Training Program [SIMBART]). Finally, R&D to train battalion and brigade staff in all mission phases (Combined Arms Operations at Brigade Level, Realistically Achieved Through Simulation [COBRAS]) has been performed.

The ARI is involved in developing innovative staff training using Brown's (1992) concept of structured training. The concept was first implemented in 1994 with ARI's Virtual Training Program (VTP) for (originally) reserve component units. This training

predominantly focused on maneuver training for armored forces platoons, companies and battalion task forces. The definition of structured training used in this research and development effort is given in Figure 2. More recently, however, ARI has undertaken additional research and development in structured training focusing particularly on staffs. This innovative structured training for staffs will be examined.

The ARI Armored Forces Research Unit (AFRU) is developing experimental R&D training programs for brigade and battalion staffs, under the FXXITP. These programs are designed to train individual staff member skills, and collective staff skills. Collective staff skills are trained for both small staff groups (i.e., targeting cell) and more complex, larger staff aggregations, such as numerous members of the brigade staff. The FXXITP is the means for determining how the Army will transition from training forces today to training forces in the future. The goals of the FXXITP are to: use simulation to enhance the quality of training; provide improvements to conserve resources; accelerate force development activities; strive to determine the optimal mix of simulation and field training necessary to maintain high levels of unit combat readiness; and develop a strategy that provides the basis for the evolution and inclusion of virtual, constructive and live simulation. The immediate goals of the ARI R&D are to identify the critical tasks for battle staffs, develop innovative individual staff training and develop structured training in simulations for staff sections, small groups and the entire staff.

One such R&D effort was called Innovative Tools and Techniques for Brigade and Below Staff Training (ITTBBST) (ARI, 1996). This effort involved identifying critical battle staff tasks (through BFs), developing individual staff training (BSTS) and developing training in simulations for staff sections and small groups (SGT).

Battlefield Functions

The BFs[1] (Lewman, Mullen & Root, 1994) were defined by TRADOC as processes or activities occurring over time that must be performed to accomplish a mission or supporting critical tasks. The seven battlefield operating systems (BOSs) were the basis for the BFs. The BOSs were (a) intelligence/electronic warfare, (b) maneuver, (c) combat service support, (d) fire support, (e) mobility/countermobility/survivability, (f) air

[1] The BFs were originally known as Critical Combat Functions (CCFs).

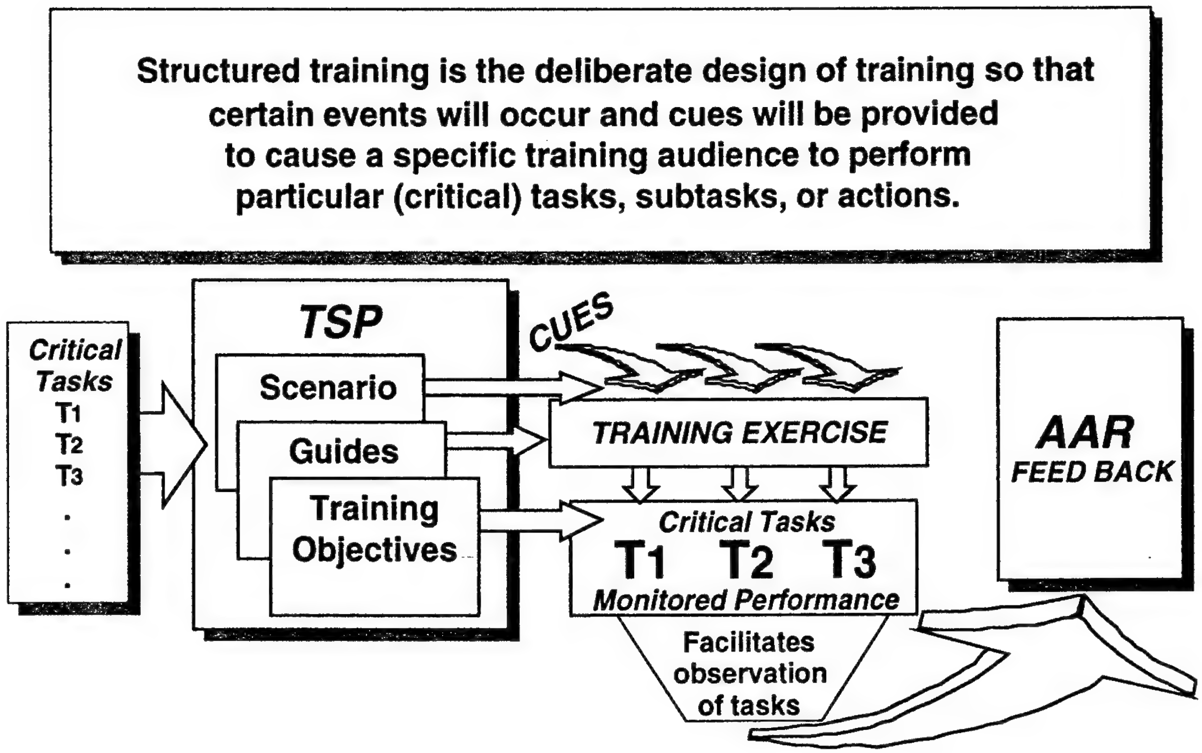

Figure 2. What is structured training?

defense and (g) command and control. The BFs divided each BOS into functions (currently 39 BFs). While three of these directly concerned battle staffs (BF 18, 19 and 20; command and control during mission planning, preparation and execution, respectively) battle staff work was contained in every BF in some form (e.g., intelligence, otherwise known as BF 4).

Analysis of the 39 functions differed from the usual method of specifying tasks for units to train. Traditionally, the Army has used ARTEP MTPs to identify tasks for training. The Army developed these MTPs for specific types of units (e.g., infantry platoon, heavy brigade). As such, the tasks were not developed in a larger context of overarching functions. Thus, one could easily overlook the fact that a task was duplicated in other functions. In addition, the tasks may not have included actions that involved cross walks with other types of units. As such, the MTP tasks may not have reflected the synchronization necessary for success on the battlefield.

The work on BFs began with analyses identifying the tasks constituting the general functions that units must perform, and the operational linkages of these tasks across BOSs (horizontal links) and across echelons (vertical links). They then fleshed

out the tasks and, ultimately, behaviors that units must execute to carry out these functions, regardless of type of unit. Therefore BFs also helped identify observable behavioral and mission outcomes, such as the MOPs and MOEs discussed by Brown (1992). Many BFs, in fact, contained an assessment package listing MOPs and MOEs for the tasks defined in the analyses.

Another advantage of BFs was that they helped training developers organize specific tasks within a larger context of the general function of these tasks. In future development efforts, this should help create a more integrated training program.

The functions and tasks relevant to battle staffs that were identified by the BFs were the basis of the continued developmental staff training (André, Wampler & Olney, 1997; Koger, et al. 1998). Progression from the training assessment and determining the tasks to be trained, through individual staff training to staff group training, is shown in Figure 3 taken from Martin (1995).

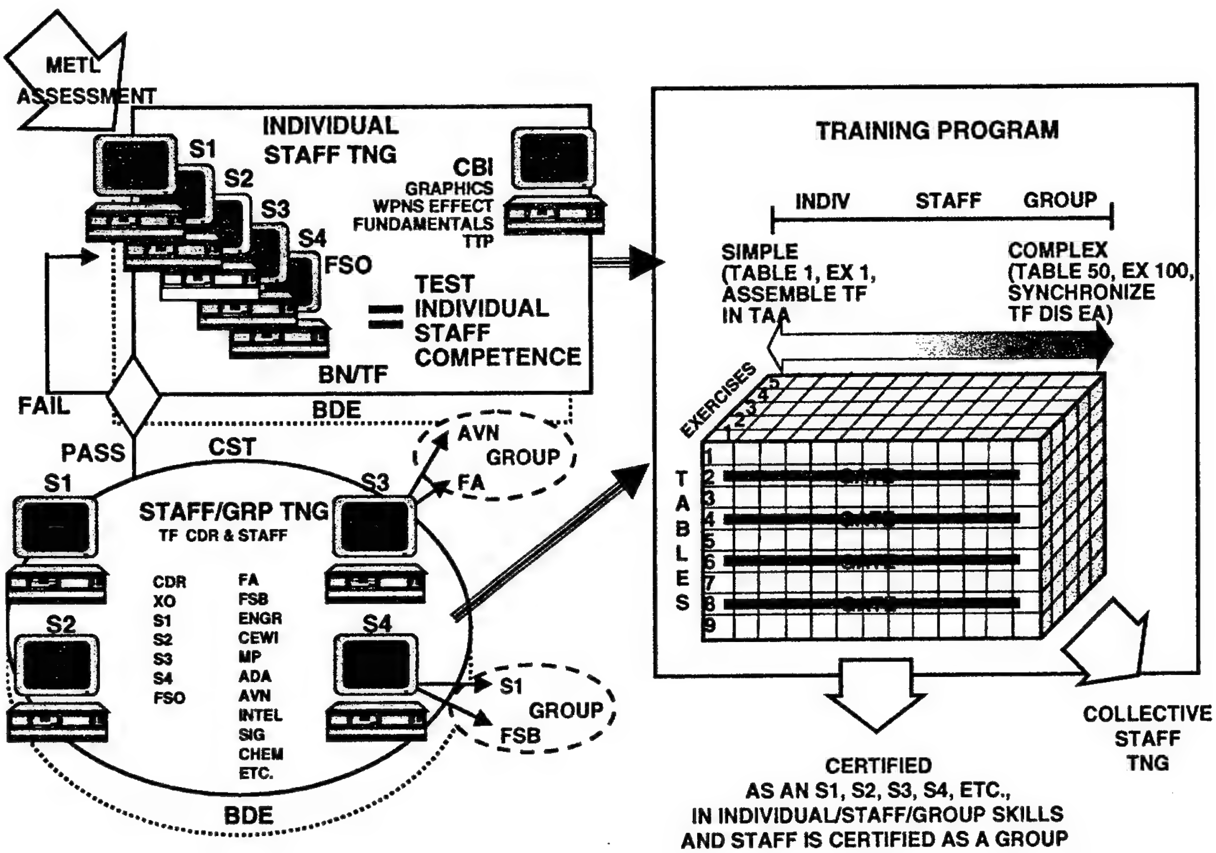

Figure 3. Structured training for individuals and staff groups. (Adapted from Martin, 1995).
Note. Acronyms are defined in Appendix A.

Battle Staff Training System

The original BSTS provided training for individual staff positions at both battalion and brigade level (André, Wampler & Olney, 1997). This training was developed in response to the problems with individual staff member performance uncovered by Thompson et al. (1994) at the CTCs. The research cited earlier found that most staff members have not received formal training in their staff positions prior to assuming a staff position. The BSTS was an attempt to consolidate materials for individual staff training so that staff members could train for their jobs, on the job. Of course, it could also be used as institutional training.

In the BSTS, there were courses covering common core, commander, XO, S1, S2, S3, S3-Air, S4, Civil Affairs Officer (S5, brigade only), FSO, engineer, ADO, signal officer, chemical officer and chaplain. Figure 4 provides a model course outline for BSTS. These courses were based on Army doctrine, lessons from the Center for Army Lessons Learned, and current trends occurring at CTCs. Each course was composed of subjects and each subject composed of lessons. Lessons took one to two hours to complete and were composed of topics. Material included both paper and computer based instruction.

Individuals completed a course by completing subjects. Individuals took a computer based pre-test on each subject, which diagnoses their current knowledge level. If the staff member passed the pre-test, then the staff member passed the subject without further effort. Passing was defined as answering 80% of the (multiple choice) items correctly. An example test item from the Brigade Common Core course was: "The _____ is responsible for the security, positioning, and operation of the brigade support area (BSA) within the brigade rear area." Alternatives are: Brigade S3; Forward Support Battalion (FSB) commander; Division; and Corps. The correct answer is FSB commander. After studying the relevant lesson(s), the staff member could take a computer based exam on the lesson(s) or proceed to the subject post-test. Staff members repeated the pattern until they passed the post-test. Then they moved on to the next subject, until finished with the course. Records of individual training progress could be maintained by a network administrator, for use by the commander or an appointed staff member. Situation based comprehensive assessments, designed to measure ability to use, versus merely recall, information learned in the course were developed. Current versions of BSTS have been used in the Armor Officer Advanced Course (AOAC), members of the 3d Brigade (Bde), 2d Infantry Division, and by members of the Experimental Force (EXFOR) at Fort Hood, Texas.

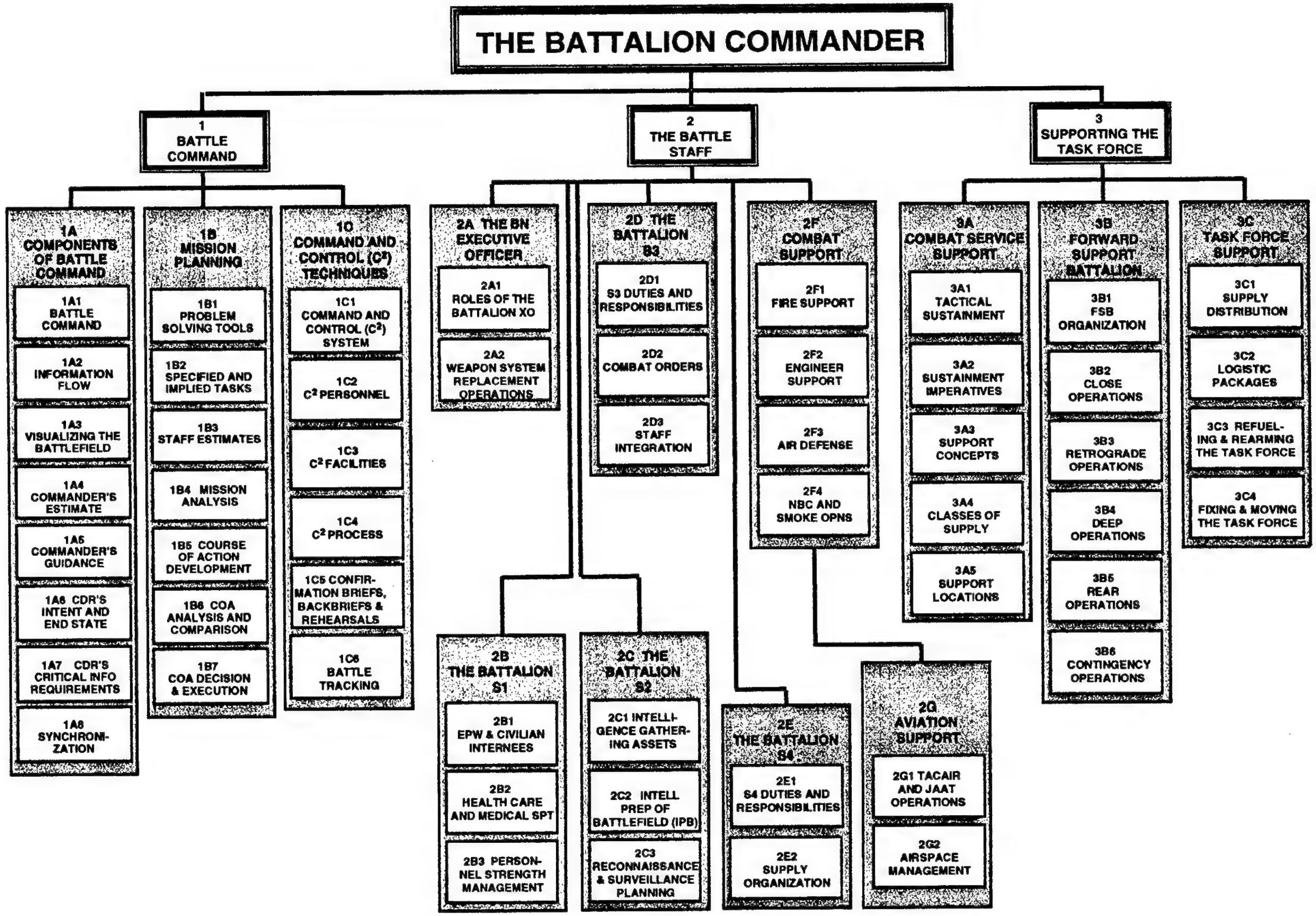

Figure 4. Model course outline for BSTS.
Note. Acronyms are defined in Appendix A.

Staff Group Trainer

The SGT served as a bridge between the individual staff skills, and those collective skills taught in more complex constructive and virtual staff simulations (see Figure 5). It was useful for inexperienced staffs or experienced staffs with newly assigned personnel. The SGT research and development effort was designed to train staff sections or small staff groups at battalion and brigade level in basic, collective mission execution skills (Koger, et al. 1998). Analysis of the BFs suggested that collective staff behaviors required to perform battlefield functions could be grouped into ten staff processes. These processes are listed and defined, in order of complexity, in Table 2. The SGT program was designed to train these processes in a progression from simple to complex or crawl, walk, run. The SGT assumed that staff members had acquired sufficient knowledge to perform their individual staff functions.

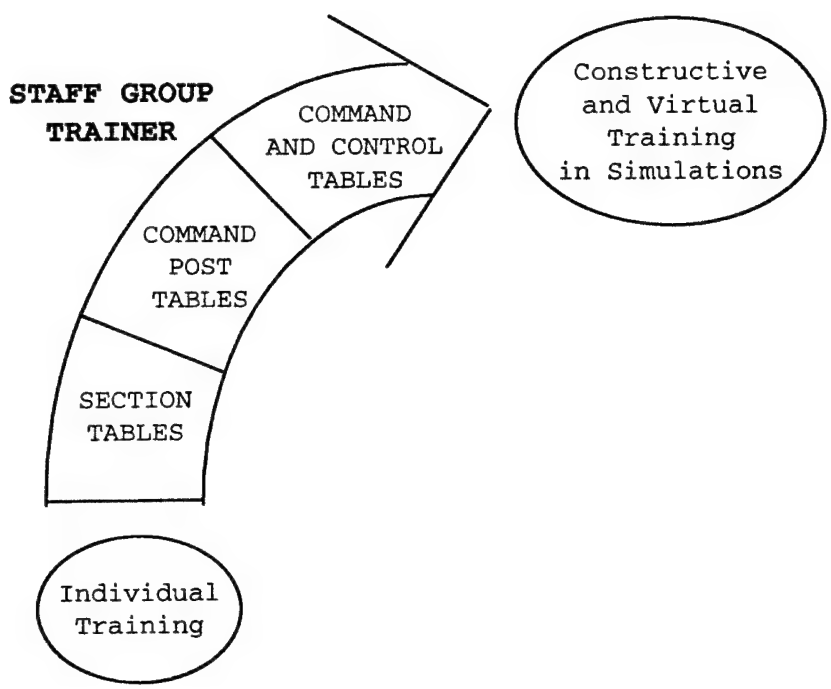

Figure 5. SGT as bridge to higher level simulation training.

Table 2

SGT Training Objectives

Training Objectives	Description
Monitor unit operations	Sections actively seek information about higher, adjacent, supporting and subordinate units. Sections acquire information by listening to reports and asking units to provide needed information.
Process information and messages	Each section collates, transforms, and organizes information. Each section stores information on maps, situation boards, journals, and files so that it can be retrieved and used.
Analyze/evaluate information	Each staff section attaches meaning, either speculative or confirmed, to information that has been acquired.
Communicate mission critical information	Each staff section transmits information or intelligence to those who must make decisions about or act on it. This includes initial transmittal by those who have sensed information; relaying by intervening levels; and disseminating throughout the staff, CP, subordinate units, and higher headquarters.
Coordinate information and intelligence	Sections exchange and discuss information and intelligence in an attempt to clarify its meaning and discern its implications.
Integrate staff input	The XO/battle captain (BC) combines information and intelligence from all sections, puts it into a useable format, and passes it to the commander to facilitate his battlefield awareness. Additionally, the XO/BC identifies areas requiring sections to combine their efforts to support the commander's intent.
Recommend a course of action to commander	The XO/BC and staff develop and analyze courses of action. Based upon this analysis, the XO/BC recommends a course of action to the commander.
Disseminate commander's decision	The staff prepares and issues orders or fragmentary orders (FRAGOs) informing units and staff of the commander's decision.
Synchronize the activities of subordinate and supporting units	The XO/BC and staff monitor unit and BOS assets to ensure their efforts are aligned to execute the commander's intent or direction.
Direct BOS assets to support commander's intent	Sections and XO/BC track activities of BOS assets and intervene, if required, to ensure their activities support the commander's intent.

The purpose of the SGT was to train staff members in fundamental collective skills needed in mission execution. All message input from subordinate elements, adjacent units and higher headquarters was scripted. After receiving a multimedia overview of the mission, staff sections operated computer workstations and routed messages, posted information to their situation maps, and extracted information for the purpose of coordination with other staff members, consolidation and reporting to the commander or higher headquarters. A data logging system recorded staff responses such as opening, closing and forwarding messages with or without comment. The system used these data, along with OC observations, in the AAR.

The training audience was slightly different at the battalion and brigade levels. The training audience at battalion level was the XO or battle captain, personnel section, intelligence section, operations section, logistics section, fire support element (FSE), engineer element, battalion maintenance officer (BMO) and medical platoon leader. At the brigade level, the training audience was the XO, personnel section (with medical representative), intelligence section, operations section, logistics section, fire support section, and engineer section.

Within each section at both levels, three types of unit personnel were involved. A specialist was trained to operate the computer workstation to open messages, post them to the map, etc. A Noncommissioned Officer (NCO) acted to direct the specialist and call the attention of the principal staff officer to important messages. The principal staff officer was primarily responsible for performing the higher staff processes (analysis, communication, coordination, etc.). The principle staff officer was the main training audience, with the NCO also receiving training in his or her actual duties. The specialist was mostly a training aid, although the specialist gained an understanding of how staffs operate. Unit commanders acted as trainers. This latter point will be discussed below.

The SGT training program, as outlined in Figure 6, was designed for staff members to progress from staff section to small group to larger group. In each of the two training support packages (one for battalion and one for brigade) that comprise the entire program, staff members progressed from staff section to CP to command and control tables.

The staff section table for both brigade and battalion trained the S1/S4, S2, S3, FSO and engineer staff sections separately. There was a separate module for each staff section. These modules contained exercises that trained the staff section in very basic staff processes, such as monitoring, processing and analyzing. In these exercises there was no interaction with

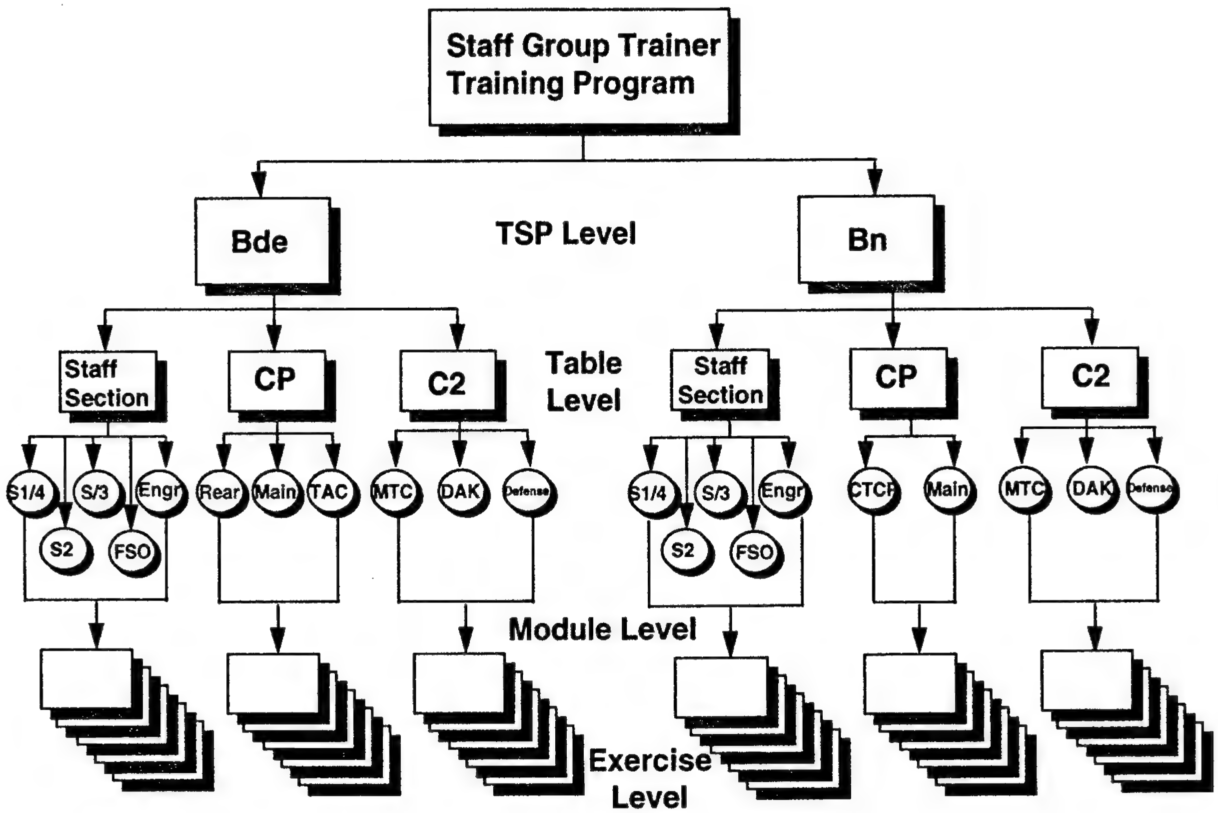

Figure 6. Project description: SGT training program.
Note. Acronyms are defined in Appendix A.

other staff sections. Staff members received information at computer workstations from external sources (e.g., subordinate units), posted it to electronic maps and analyzed the information. The staff section tables used only the movement to contact mission.

The CP table was the next level for both battalion and brigade TSPs. The CP table trained the combat trains command post (CTCP) (S1/S4, medical platoon leader and BMO) and main CP (XO or battle captain [BC], S2, S3, FSO, engineer) at battalion level. At brigade level the CP table trained rear CP (S4, S1 with medical representative and support operations section), main CP (XO, battle captain, S2, S3, FSE, engineer and assistant S4 representative) and tactical command post (TAC) (S3, S2, FSE).

There were separate modules for each CP for both battalion and brigade TSPs. The exercises in these modules focused on training the staff processes of communicate, coordinate, integrate and recommend. Since earlier processes must be performed prior to these processes, they also received some training. Staff sections within a given CP interacted in these

modules, but no live interaction between CPs occured. That is, if information needed to pass between CPs, an interactor was used to role-play the individual(s) in the other CP. The CP tables used only the deliberate attack mission.

The C2 table was the final table for both battalion and brigade TSPs. The C2 table trained interactions between CPs. Due to the lack of workstations at brigade level, all three CPs were not used at any one time. There are separate modules for each mission; movement to contact, attack and defend. These missions were taken from SIMBART (to be discussed later), and used the NTC data base. Here the staff processes of disseminate, synchronize and direct were emphasized, although all previous processes were of necessity performed as well. In the exercises in these modules, interaction between CPs occurred.

Each of the modules in all tables consisted of several exercises varying in level of difficulty. Difficulty was determined by message speed and relevance. The least difficult exercises in a module had message speed slower than real time and a higher percentage of relevant messages.

There were two types of AARs, end of exercise AARs and end of module AARs. The end of exercise AARs were held within staff sections only. The end of module AARs involved the entire CP (for the CP table) or entire staff for the C2 table.

In exercises involving the full staff, the commander personally assisted in training the staff. Discussion focused on staff integration and what decisions the commander made and why. This led into discussion of what the commander knew or what the staff told the commander at certain times. The provided teaching points centered around the concept that the staff built the commander's situation awareness by what information they provided to each other and to the commander at certain times. Therefore if the commander or other staff members failed to get information, got incorrect information, or got correct information too late, poor decisions may have resulted.

The concept of the window of opportunity for certain information was introduced. That is, staff sections and CPs had only a certain amount of time to provide information to those who needed it. The earlier in that window the information was provided, the more useful the information was. At some point that information was overtaken by events and became useless.

Feedback provided in these AARs was a mixture of automated and OC collected feedback. Automated feedback included information concerning effective message handling. Examples of such feedback included whether relevant (and irrelevant) messages

were opened, whether messages were routed to those (and only those) who needed the information, and speed in accomplishing these functions. Information collected by OCs included more subjective matters such as whether information was analyzed correctly and if information and actions were properly coordinated and integrated among staff sections.

A formative evaluation, consisting of a pilot and trial run with a group of SMEs as staff, was conducted for the SGT. Some of the major challenges uncovered were the complexity of the orders, difficulty of the computer software, and problems with AAR materials.

Additional R&D on SGT was performed to address these challenges. The new prototype program was designed at brigade level only, as a proof of principle. Section level, small group (e.g., fire coordination cell) and main CP modules were developed, with only one exercise per module. One mission (defense in sector) was used, versus the three in the prior program. Major changes in the program involved simplifying the orders materials needed to execute the mission, improving ease of use of training equipment, and better AAR feedback.

Tactical materials provided to the staff were greatly abbreviated. Computer assisted training was designed to help to ensure that the section members understood the tactical materials prior to running an exercise. Most of the information needed for the exercise was in the synchronization matrix, decision support template and commander's critical information requirements (CCIR).

The interface to the training equipment was improved to provide ease of use; to avoid the equipment interfering with the training. Placing unit locations on maps was made faster and easier, so that workstation operators did not have to choose between updating maps, opening messages, or typing messages. Equipment to make the interactors' (i.e., white cell) job easier, such as touch screens and voice recognition software was explored.

Performance feedback was improved. More computer generated feedback was available for each section. This feedback included what information was sent to a specific address (e.g., division operations section) and when it was sent, compared to the information that should have been sent to that source at that time (e.g., window of opportunity). The observer checklists were improved by specifying expected inter-staff behaviors clearly enough that observers could easily determine whether or not they occurred. Also, observer checklists were put on a personal data assistant (PDA), with an alarm alerting the OC to when a critical

event was occurring. Improved train-the-trainer materials were developed to help observers run effective AARs.

Janus Mediated Staff Exercises (JMSE)

SIMUTA. Once individual staff members, staff sections and small staff groups have received training in fundamental staff skills, they should be ready for more intense training as a staff. The VTP, resulting from a series of ARI contracted efforts included such training (Hoffman, Graves, Koger, Flynn & Sever, 1995). One part of the VTP centered on battalion staff training for the primary staff.

The SIMUTA portion of the JMSE also followed the structured training model. Each mission was designed to require certain staff actions on specific MTP tasks. Materials furnished included OPORDs from battalion and brigade, maps and overlays. The training focused on execution of an operational plan already developed, although (unlike SGT) the commander had some real decision making capability. Materials provided a script of communication from higher and adjacent units. Subordinate (e.g., company) commanders could be drawn from the training unit or from the OC team. Regardless, training materials provided them with general guidelines for actions and reporting, although not actual verbatim scripts. The training materials also provided the OPFOR with general guidance. A given mission played out somewhat differently each time, but the cues eliciting staff actions were generally the same. There were three missions. These were: movement to contact, deliberate attack and defend, which used the NTC data base. These were the same missions executed at the NTC: movement to contact, attack and defend. These missions also used the NTC terrain data base.

A group of OCs assisted with the training. The OCs ensured that both the staff being trained and OPFOR stayed within bounds of executing the mission so that the exercise met training objectives. They also observed training in order to lead the AAR. In the AAR, the group discussed the tasks that the exercise trained. The OCs noted tasks performed to standard as well as reasons for deficiencies in tasks not executed to standard. Whether the unit lost or won the battle was immaterial, except to prompt discussion concerning why certain actions, positive or negative, happened.

After constructive, structured, staff training in Janus, battalion staffs could proceed to virtual training in SIMNET. This training followed the same principles and design outlined above, except that subordinate commanders came from the training unit and the materials provided them little external guidance outside of the OPORD. That is, subordinate commanders could

provide no (or incorrect) information about battlefield events, and could incorrectly execute orders from the staff. In other words, these exercises introduced more "fog of war" for the staff to work through.

Higher level structured training in simulation was also developed for the brigade staff. These research and development efforts were named Simulation Based Mounted Brigade Training Program (SIMBART) and Combined Arms Operations at Brigade Level, Realistically Achieved through Simulation (COBRAS).

Simulation Based Mounted Brigade Training Program. The SIMBART program (Koger, et al. 1996) focused on training the brigade staff in the execution stage of the mission. The contract had three objectives. The first objective was to produce behavioral cues that trigger specific staff actions. The second objective was to train collective (staff sections, CPs and the entire staff) versus individual staff behaviors. The third objective was to provide a high likelihood of mission accomplishment. The rationale for the latter objective was that if staffs failed to accomplish the mission, staff behavior in the AAR would likely focus on face saving behavior, such as denigrating the simulation or the OPORD they were to execute. This would interfere with discussion of actual staff behavior on tasks the simulation was designed to train.

Table 3 gives the training audience for SIMBART. In the Tactical Command Post (TAC CP), the training audience consisted of the commander, members of the S2 section, S3 and members of the S3 section, fire support coordinator (FSCOORD) and ALO. In the main CP, training audience consisted of the XO, S2 and members of the S2 section, members of the S3 section, members of the fire support section, engineer section and the chemical or nuclear/biological/chemical (NBC) officer. In the rear CP, the training audience included S1 and S4, plus members of their sections.

The missions were brigade movement to contact, area defense and deliberate attack. The simulation used for mission execution was Janus. These missions also used the NTC data base common to the SIMUTA battalion missions. Because of the seamless nature of these missions, it may be possible in the future, through distributed interactive simulation (DIS), to train battalion staffs and the brigade staff simultaneously in constructive simulation or virtual and constructive simulation (Simulation Network [SIMNET]-Janus).

The conduct of the training was similar to that described under SIMUTA. That is, the staff executed an existing OPORD designed to train specific collective tasks. An extensive OC

team provided role players for subordinate units (i.e., battalion for four battalions) adjacent units and higher headquarters, as well as observers for each CP.

Table 3

SIMBART Training Audience

Tactical command post (TAC CP)	Main command post	Rear command post
Brigade Commander[1]	Executive Officer	S4 Supply Sergeant Supply Specialist
S3[1] Assistant S3 Operations Sergeant Operations Assistant	Assistant S3 or S3 Air Operations Sergeant Operations Assistant S3 Plans Officer S3 Plans Assistant Officer	S1 Personnel Services NCO Personnel Admin Specialist
Assistant S2 Intelligence Sergeant Intelligence Analyst	S2 Intelligence Sergeant Intelligence Analyst S2 Plan Officer	
Fire Support Coordinator (FSCOORD)[1]	Brigade Fire Support Officer Fire Support Targeting Officer Fire Support NCO Fire Support Specialist (2)	
Air Liaison Officer (ALO)[1]	Engineer Officer Engineer Sergeant Chemical Officer or NBC NCO	

[1] Location is optional, preferably with the Command Group, but can be located in the TAC CP.

Combined Arms Operations at Brigade Level, Realistically Achieved through Simulation (COBRAS)

The COBRAS research and development effort (Campbell, Graves, Deter & Quinkert, 1998; Jenkins, Graves & Quinkert, in preparation) involved brigade level vignettes, brigade staff exercises (BSE) and brigade and battalion staff exercises (BBSE). This effort was designed for home station training for all mission phases.

Vignettes. The COBRAS vignettes were 24 short, self-contained training activities that focused on specific staff process events and on selected members and groupings of the staff. Vignettes are shown in Table 4. These vignettes were structured training events in that they provided all the necessary components to implement and conduct training. Each vignette was designed to provide practice and feedback on explicit objectives and tasks. The TSP for a vignette defined the objectives, outcomes and limits of the training experience. The structure also included the tactical scenario that provided the framework for the required activities. Four of the vignettes used constructive simulation (Brigade/Battalion Battle Simulation [BBS] or Janus) to generate event scenarios, while the rest were conducted "live" or without simulation system support. Duration of vignettes ranges from four hours to eight hours.

BSE. The COBRAS BSE training program components included integrated scenarios covering the planning, preparation, and execution-consolidation-reorganization phases of battle. The BSE gives the brigade commander and selected staff an opportunity to practice and refine staff processes. The target audience is shown in Table 5. The BSE can be used for several purposes. It serves as a training tool when a new commander takes over or other major changes in the Brigade Combat Team's (BCT's) leaders or staff occur. The exercise allowed the commander to communicate his decision making process to the BCT and refine the standing operating procedure (SOP) necessary to carry out that process. The BSE could also serve as a sustainment tool to further practice and refine those procedures.

Table 4

COBRAS Brigade Staff Vignettes

Event	Participants
Plan for dislocated civilians	S1, S2, S4
Plan for refuel on the move (ROM)	S4, FSB Cdr
Develop concept of service support	S1, S4
Develop recon and surveillance plan	S2, S3
Conduct target development	XO, S2, S3, FSO
Develop air defense concept	S2, S3, ADCOORD
Develop contingency plan	S2, S3, FSO, ENG
Conduct mission analysis	XO, S1, S2, S3, S4, ENG, FSO, ADCOORD
Develop courses of action	XO, S1, S2, S3, S4, ENG, FSO, ADCOORD
Conduct course of action analysis	XO, S1, S2, S3, S4, ENG, FSO, ADCOORD
Conduct special staff rehearsal	XO, S2, S3, ENG, FSO, ADCOORD
Develop reconnaissance order	S2, S3, ADCOORD, CHEMO, FSO, MI Co Cdr, ENG, SIGO, S4
Plan NBC defense operations	S2, S3, CHEMO
Plan deliberate smoke operations	S2, S3, CHEMO, FSO
Identify and resolve airspace conflicts	S3, S3-Air, ADCOORD, ALO, Avn LNO, FSO
Develop a COA branch	S3, FSO, Avn LNO, ENG
Plan brigade rear battle	S2, S3, FSO
Conduct a brigade rehearsal	Bde Cdr, XO, S2, S3, S4, FSO, FSCOORD, ENG, ADCOORD, CHEMO, Bn TFs/Cdrs
Plan CSS rehearsal	S1, S4, FSB Cdr
Conduct accelerated decision making process	Bde Cdr, XO, S1, S2, S3, S4, ENG, FSO, FSCOORD, SIGO, ALO, CHEMO, ADCOORD, MI Co Cdr
Coordinate mission operations (Janus)	XO, S2, S3, ENG, FSO, ADCOORD
Coordination mission transition--offense to defense (BBS)	XO, S1, S2, S3, S4, FSB Cdr, ENG, FSO, ADCOORD
Conduct parallel planning (BBS)	Bde Cdr, XO, FSB Cdr, S1, S2, S3, S4, ADCOORD, CHEMO, ENG, FSO, MI Co Cdr
Prepare and execute FRAGO (Janus)	Bde Cdr, FSCOORD, XO, S2, S3, ADCOORD, CHEMO, ENG, FSO (JANUS)

Note. Acronyms are defined in Appendix A.

Table 5

BSE Training Audience

Commander
XO
S1
S2
S3
S4
FSO
ENG
FSCOORD
FSB Commander
ADCOORD
MI Company Commander
Aviation LNO
CHEMO
MP Platoon Leader
SIGO

The strength of the BSE lay in its focus on the workings of the brigade staff. The emphasis was on the interactive tasks which occurred between various sections or individuals. There were four performance-oriented training goals for the brigade staff. First, performance of the full mission requirements was trained, including all mission phases. Second, sequential performance of the military decision making process (MDMP), performed both without time pressure, and under constrained time conditions, was trained. Third, complete production of planning and preparation products, including interim products and inputs was trained. Finally the training included integration of selected combat support and combat service support functions into the staff processes.

Within those four goals, the training placed special emphasis on CSS, planning and the decision making process. The Brigade/Battalion Battle Simulation (BBS) was used to generate the information, cues and simulated operations that allowed CSS to be a major consideration. This required CSS-directed staff actions during all phases of the exercise. The exercise also covered the full array of staff activities. An integral part was the requirement to conduct the full planning process. The exercise addressed both the MDMP and an accelerated version of the process at different points. Two of the missions provided the needed time for the brigade staff to use the MDMP to develop its plan: movement to contact and deliberate attack. Limited time was available in the area defense mission, requiring the brigade to use an accelerated process.

In preparation for the exercise, all members of the primary training audience received a list of the tasks they would perform during each of the missions. The exercise conditions were designed so that the tasks would be cued and would contribute to the unit's success.

Performance feedback was provided to the primary training audience in three ways. First, observers were assigned to monitor individual members of the brigade staff. As the exercise was conducted they were available for discussion and suggestions on how various aspects of the staff member's job should be performed, how products should be generated, and which of the other staff members should be involved. Second, observers also conducted informal feedback for small groups of other staff members as needed. Third, the senior observers conducted AARs at specified points in the exercise. The AARs focused on staff processes required during the just completed segment of the exercise. The method for attaining that focus was a process of examining and discussing staff products and other process outcomes. The AARs occurred approximately every six hours.

The TSP for BSE also contained brigade staff preparation materials and guidance; simulation system electronic files and documentation; instructions for interactors and role players; materials and guidance to support observation and feedback; and complete details for exercise conduct and control. The majority of the work provided from this research effort focused on selected groups of brigade commander and staff members, as shown in Table 5.

BBSE. The BBSE was designed for a staff that has already defined and practiced its procedures for using the MDMP and made them a part of its SOP. The training audience for the BBSE is shown in Table 6. After the staff has progressed to this level the BBSE provided a training environment where the staff can: train on critical collective tasks; experience an intense battle rhythm with concurrent handling of multiple missions; and practice planning in parallel with subordinate units in a continuous, uncertain battlefield environment.

Table 6

BBSE Training Audience

Brigade level	
Brigade commander	Brigade FSO and FSE
Brigade XO	Brigade fire support coordinator
Brigade S1 and section	Air defense artillery (ADA) coordinator and section
Brigade S2 and section	FSB commander and support operations section
Brigade S3 and section	Military intelligence (MI) company commander and headquarters section
Brigade S4 and section	Military police (MP) platoon leader and platoon sergeant
Chemical officer and section	Army aviation liaison officer
Brigade engineer and section	U.S. Air Force (USAF) ALO
Brigade signal officer	

Observed battalion task force (TF) level		
TF commander	TF S3 and section	Signal officer
TF XO	TF S4 and section	TF FSO and FSE
TF S1 and section	Chemical officer and section	TF ADA platoon leader
TF S2 and section		TF liaison officer (LNO)

The scenario was designed to generate the demanding conditions for continuous operations. The BCT staff and all supporting elements were exercised for 24 hour operations. The BCT headquarters and its maneuver task forces operated from their CPs, which were linked to a simulation center with BBS as the exercise driver. Because this exercise was designed to generate a training environment that in intensity and rhythm was similar to actual operations, units were encouraged to set up the CPs as they would in field conditions. This applied to the TAC, main and rear CPs of the brigade and to the command group, main CP and CTCP of the task forces. This configuration allowed the staffs to train with the assets that were available in the field and to determine how their organization and arrangement contribute to or detract from the staff process.

A tactical scenario was presented to the BCT that caused the targeted training audience of commanders and staffs of the brigade and maneuver task forces to plan, prepare and execute a series of missions. While all actions associated with those mission phases occurred and were practiced, feedback was focused on a limited number of topics selected at the start of the exercise.

The selected topics, called performance objectives, provided the specific training objectives for the exercise. They can best be categorized as collective commander and staff skills that allowed the brigade to enter its next level of operations or training at a higher level. In the case of an NTC rotation, these skills would help units prepare to get the most from an upcoming full-up live training experience. These performance objectives focused the exercise by providing topics for the scheduled and impromptu feedback sessions with the training audience. Feedback was provided by peer observers from other units and was designed for the commanders and staffs of the brigade and maneuver task forces.

The entire exercise was supported by a complete TSP which included all the instructions, materials, orders and simulation materials necessary to execute the training with minimal preparation.

Research that focused on a variant of the BBSE involved a synthetic theater of war (STOW) exercise. In the STOW variant subordinate leaders of one battalion were trained in virtual simulation (SIMNET); and their staff, plus other battalion staffs trained in a constructive simulation (BBS). The brigade staff was also in a constructive environment (BBS). This training followed the same principles and design outlined above, except that subordinate commanders came from the training unit and the materials provided them little external guidance outside of the operations order. These exercises introduce more "fog of war" for the staff to work through.

A major goal in the design of the entire COBRAS training program was that it be designed for execution without a dedicated OC team. A thorough train-the-trainer package was included so that a division could prepare for and conduct training for a brigade at home station (provided BBS is available). This development should aid exportability, since a full time OC team does not have to be provided.

The COBRAS program has been used in the field. A version of COBRAS was recently tested with the 3d Bde 2ID at Fort Lewis, Washington. The training was used to prepare the relatively new brigade staff for an NTC rotation. In addition to this work, the Force XXI Training Program's Implementation Support Assessment Team (ISAT) is using COBRAS vignettes, BSE and BBSE, along with BSTS at Fort Riley Kansas.

In summary, the Army is aware of and attempting to correct the current deficiencies in battle staff performance and their potential effects. The ARI is executing the FXXITP in order to develop ways to provide training to ameliorate these deficiencies. These research and development efforts already performed included a project to identify critical battle staff functions and tasks for training (BFs). Another effort involved developing training for individual staff members (BSTS). Yet another provided fundamental training for staff sections and small groups (SGT). Other programs trained the entire battalion or brigade staff on mission execution tasks (SIMUTA, SIMBART). Finally, efforts to train battalion and brigade staff in all mission phases (COBRAS) have been undertaken.

These were recent research and development efforts. A version of BSTS, as well as versions of SIMUTA (JMSE), SIMBART and COBRAS are available for use by staffs today. These products offer promise for effective training of staffs in the Army of the future.

A Proposed Stepping Stone Training Approach

Figure 7 shows how the innovative training efforts could fit together in a training program for battalion and brigade staff. This one dimensional figure is somewhat oversimplified in that any training approach should consider at least the two dimensions of complexity of training (ranging from individual, small group, single staff and brigade plus subordinate staffs) and mission phase (i.e., plan, prepare, and execute, consolidate, re-organize). Some TSPs may be designed to train all mission phases for a given level of complexity. For instance COBRAS BSE trains all mission phases for the brigade staff. Other TSPs train only a single mission phase for a given level of complexity. For example SGT trains only the execute phase for small staff groups.

Both the battalion and brigade training starts out with the training of individual staff skills (i.e., BSTS), such as training the S2 to produce an intelligence preparation of the battlefield (IPB). The BSTS concentrates primarily on the plan and prepare mission phases.

Then the training progresses to training small staff group processes such as analyzing information, communicating and coordinating with each other and providing recommendations to the commander. Small group skills are trained first in the execution phase (i.e., SGT) and then in the plan and prepare phases (COBRAS vignettes). These vignettes could also help prepare a brigade staff for multiechelon training.

Next, complex battle staff exercises train the staff and subordinate commanders in the full gamut of skills necessary to help the commander command and control operations, first in the execution phase (virtual training program, e.g., SIMBART) and then in the plan, prepare and execute-consolidate-reorganize phases (COBRAS brigade staff exercises). Commanders make, and staffs must implement decisions that will influence the flow of battle.

Finally, subordinate unit staffs are involved in all mission phases. In STOW the leaders from platoon and above in one battalion are trained in a virtual simulation; and only company commanders and staff are trained in a constructive simulation for the other two battalions. The brigade staff is also in a constructive environment.

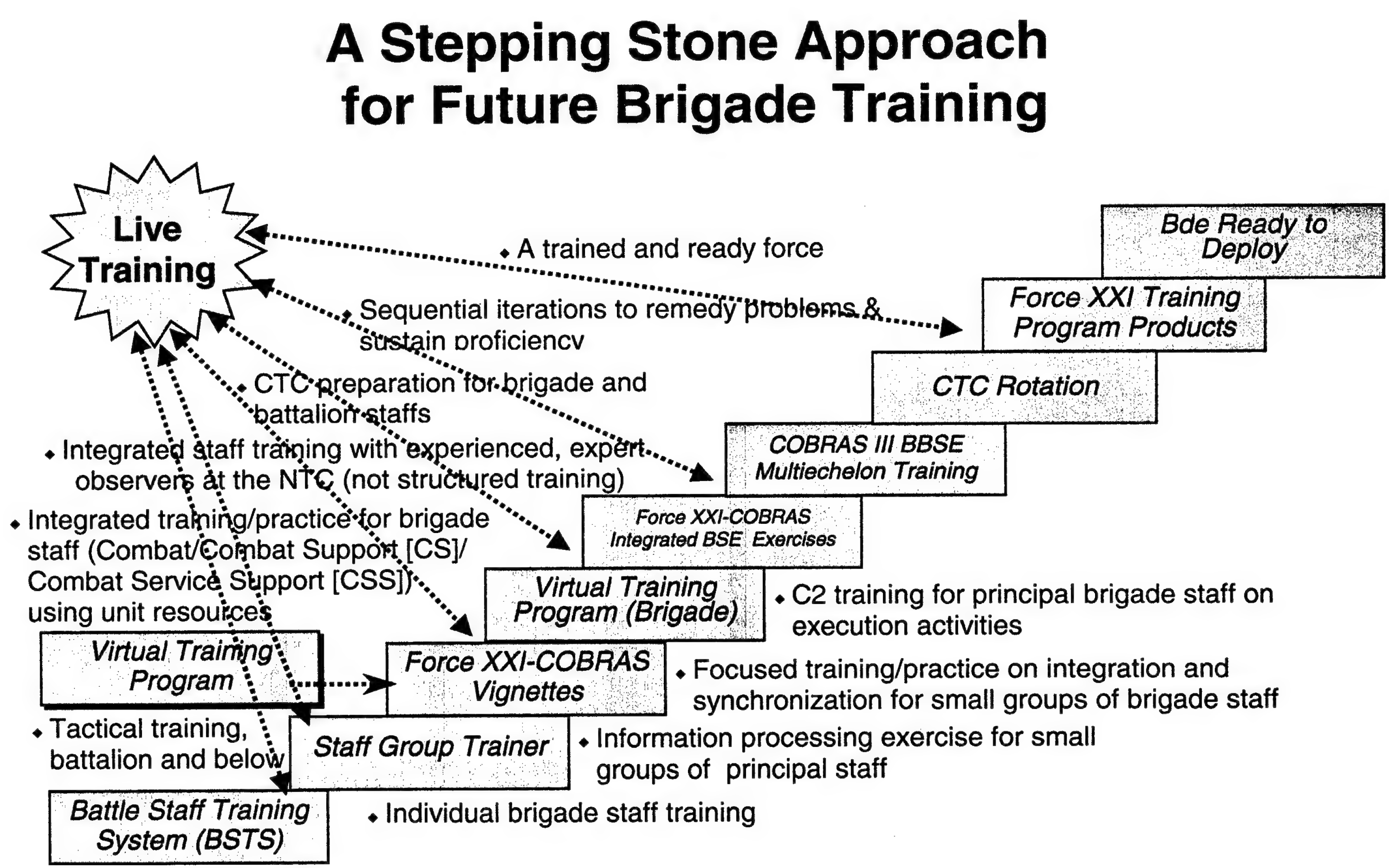

Figure 7. Battalion and brigade simulations staff training program (B2S2TP).

Future Battle Staff Training

The R&D efforts discussed above, as parts of the FXXITP, are based on conventional operations. Staffs must become proficient in the staff processes listed in Table B-3 regardless of whether they are using conventional or digital communications. Once staffs can master the collective tasks necessary to synchronize combat power, training to transfer these skills to a digital environment can be profitably undertaken.

Simulation-Based Multiechelon Training Program for Armor Units-Digital (SIMUTA-D)

Some R&D on staff training in a digital environment has been performed. One excursion of SIMUTA, called SIMUTA-D, was designed to provide digital training to battalion staffs (Winsch, Garth, Ainslie & Castleberry, 1996). The SIMUTA-D program used the SIMUTA scenarios for movement to contact, deliberate attack and defense in sector as a baseline. Then a front end analysis was performed to determine how the training requirements would be affected by the introduction of digital systems. The specific digital systems used in SIMUTA-D were legacy, versus current, digital systems: the Inter-Vehicular Information System (IVIS), brigade and battalion command and control system (B2C2), the All Sources Analysis System (ASAS) and the Improved Fire Support Automated System (IFSAS). Then TSPs supporting structured training were developed around these modified scenarios.

Several lessons were learned from SIMUTA-D. Adequate training of OCs and battle staff on digital systems must take place prior to the SIMUTA-D training. More detailed tactics, techniques and procedures (TTPs) for digitally equipped staffs are needed. Automated data collection techniques are needed to provide feedback for a digital staff. That is, behaviors that could be monitored over operational radio nets are unobservable to OCs when digital systems are used in training. Some method of capturing these behaviors in a digital environment is needed. The Army must develop structured training programs using the emerging digital systems in order to meet future training needs. One current effort is to adapt conventional Simulation-Based Multiechelon Training Program for Armor Units—Battalion Exercise Expansion (SIMUTA-B) and SIMBART TSPs for use by units currently equipped with digital communications systems (i.e., the EXFOR at Fort Hood).

Strategy for the Development of Future Training

Lessons learned from the Focused Dispatch digital battalion level Army Warfighting Experiment (Elliott, Sanders & Quinkert, 1996) suggest areas for future research and development in battle

staff training. Staff members lacked procedural skills in using digital equipment effectively. This deficit impacted on staff members acquiring, analyzing and communicating information under conditions of heavy message traffic. Also, problems existed in information management (e.g., information overload). If staff members have difficulty in quickly distinguishing important from trivial information this can also impact on the timely availability of information necessary to make critical decisions.

Finally, staff synchronization was lacking. When staff members do not know what information others need, communication and coordination of information among the staff is impaired. This, in turn, can decrease situation awareness and the ability to make correct decisions, especially in a timely manner. Future research plans should focus on each of these areas. Individual staff members need training on how to effectively operate digital equipment. Staff members also need training on information management techniques. Finally, the staff as a whole needs training in how to function as a team.

Future training should address skills needed to effectively operate digital equipment. Current training on digital equipment for procedural skills stresses step by step actions. Anecdotal reports suggest these skills decay very rapidly without additional training. A prototype program using a more cognitive approach, such as menu-navigation may be useful. This approach could be compared to the current training used to determine its relative effectiveness. Eventually, multi-media training using such an approach may be developed and tested.

Future training should enhance information management skills. With the increase in volume and speed of information generated by digital communication, managing and processing this information will be a challenge. One possible solution is training in cognitive strategies for information management such as techniques to filter, sort or group, prioritize and interpret incoming information. A digital, scripted information management exercise could be developed to teach staff sections these strategies in the context of a specific mission (DA, 1998). Feedback could be automated to facilitate training at home station without a dedicated OC team.

Also, digital staffs must have ways to integrate the information received in order to synchronize actions. Training in shared mental models, group decision making and situation awareness may help staffs synchronize actions. For example, if each staff member has an idea of what decisions or actions other staff members need to take, what information they need in order to do so, when they need that information and who has the information, communication can be pushed and pulled more

efficiently. Digital, scripted exercises for CPs or the entire staff could be developed to instruct the mental models, decision making techniques or situation awareness techniques in the context of a specific mission.

Further, the structured training packages reviewed above are primarily designed to train specific tasks and task related skills. While task related skills are crucial to staff success, interpersonal or teamwork related skills are also important, as the research by Oser, McCallum, Salas, and Morgan (1989) demonstrates. Perhaps tools for OCs to record and provide feedback on teamwork related skills, for both digital and conventional communication, are needed.

Summary and Conclusions

This report demonstrated the need for, and examples of, innovative training for brigade and battalion staffs. The report documented staff deficiencies, and discussed methods that military subject matter experts have suggested for dealing with these deficiencies. Examples of R&D prototype training programs for training individual staff members (cognitive and specific skills training), small staff groups and larger more complex staff aggregates were presented. Future R&D trends in staff training were also discussed.

As the U.S. Army continues to evolve to meet the changing needs of the nation and to leverage new technologies, training must continue to evolve as well. Training has been and will continue to be the glue that holds units together under the stresses of combat.

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Appendix A

Acronyms and Abbreviations

AAR	After-Action Review
ADA	Air Defense Artillery
ADCOORD	Air Defense Coordinator
ADO	Air Defense Officer
AFRU	Armored Forces Research Unit
ALO	Air Liaison Officer
AOAC	Armor Officer Advanced Course
ARI	Army Research Institute
ARTEP	Army Training and Evaluation Program
ASAS	All Sources Analysis System
AVN	Aviation
B2C2	Brigade and Battalion Command and Control System
B2S2TP	Battalion and Brigade Simulations Staff Training Program
BARS	Behaviorally Anchored Rating Scale
BBS	Brigade Battle Simulator
BBSE	Brigade and Battalion Staff Exercise
BC	Battle Captain
BCT	Brigade Combat Team
Bde	Brigade
BF	Battlefield Function
BMO	Battalion Maintenance Officer
Bn	Battalion
BOS	Battlefield Operating System
BSA	Brigade Support Area
BSE	Brigade Staff Exercise
BSTS	Battle Staff Training System
C2	Command and Control
CALL	Center for Army Lessons Learned
CAS	Close Air Support
CBI	Computer Based Instruction
CBT	Computer-Based Training
CCF	Critical Combat Function
CCIR	Commander's Critical Information Requirements
CDR	Commander
CEWI	Combat Electronic Warfare Intelligence
CGSC	Command and General Staff College
CHEM	Chemical
CHEMO	Chemical Officer
CIC	Combat Information Center
COA	Course of Action
COBRAS	Combined Arms Operations at Brigade Level, Realistically Achieved Through Simulation
CP	Command Post
CPX	Command Post Exercise
CS	Combat Support
CSS	Combat Service Support

CTC	Combat Training Center
CTCP	Combat Trains Command Post
DA	Department of the Army
DAK	Deliberate Attack
DIS	Distributed Interactive Simulation
ENGR	Engineer
EXFOR	Experimental Force
FA	Field Artillery
FAC	Forward Air Controller
FITE	Familiarity, Importance, Time, and Effort
FM	Field Manual
FRAGO	Fragmentary Order
FSB	Forward Support Battalion
FSCOORD	Fire Support Coordinator
FSE	Fire Support Element
FSO	Fire Support Officer
FXXITP	Force XXI Training Program
FY	Fiscal Year
IDEA	Identifying gaps in information, De-conflicting arguments, Evaluating hidden assumption, and taking Action
IFSAS	Improved Fire Support Automated System
INFO	Information
INTEL	Intelligence
IPB	Intelligence Preparation of the Battlefield
ISAT	Implementation Support Assessment Team
ITTBBST	Innovative Tools and Techniques for Brigade and Below Staff Training
IVIS	Intervehicular Information System
JAAT	Joint Air Attack Mission
JMSE	Janus Mediated Staff Exercises
JRTC	Joint Readiness Training Center
LNO	Liaison Officer
LTC	Lieutenant Colonel
MAPEX	Map Exercise
MDMP	Military Decision Making Process
METL	Mission Essential Task List
MI	Military Intelligence
MOE	Measure of Effectiveness
MOP	Measure of Performance
MP	Military Police
MTC	Mission Training Plan
MTP	Mission Training Plan
NBC	Nuclear, Biological and Chemical
NCO	Noncommissioned Officer
NTC	National Training Center

OC	Observer Controller
OE	Organizational Effectiveness
OJT	On-the-Job Training
OPFOR	Opposing Force
OPNS	Operations
OPORD	Operation Order
P	Needs Practice
PDA	Personal Data Assistant
R&D	Research and Development
ROM	Refuel on the Move
S1	Personnel Officer
S2	Intelligence Officer
S3	Operations Officer
S4	Logistics Officer
S5	Civil Affairs Officer
SGT	Staff Group Trainer
SIG	Signal
SIGO	Signal Officer
SIMBART	Simulation-Based Mounted Brigade Training Program
SIMNET	Simulation Network
SIMUTA	Simulation-Based Multiechelon Training Program for Armor Units
SIMUTA-B	Simulation-Based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion
SIMUTA-D	Simulation-Based Multiechelon Training Program for Armor Units-Digital
SME	Subject Matter Expert
SOP	Standing Operating Procedure
SPT	Support
STARTEX	Start of Exercise
STOW	Synthetic Theater of War
T	Trained
TAA	Tactical Assembly Area
TAC	Tactical
TAC CP	Tactical Command Post
TACAIR	Tactical Air
TACT	Team Adaptation and Coordination Training
TADSS	Training Aids, Devices, Simulators and Simulations
TARGET	Targeted Acceptable Responses to Generated Events or Tasks
TDM	Tactical Decision Making
TDMP	Tactical Decision Making Process
TEWT	Tactical Exercise Without Troops
TF	Task Force
THP	Take Home Package
TMT	Team Model Trainer
TOC	Tactical Operations Center
TRADOC	Training and Doctrine Command
TSP	Training Support Package

TTP	Tactics, Techniques and Procedures
U	Untrained
USAF	United States Air Force
VTP	Virtual Training Program
XO	Executive Officer

Appendix B

Empirical Research on Tactical Decision Making (TDM) Teams and Their Training

Behavioral research literature relevant to battle staffs and their training exists. This literature addresses TDM teams that assist the commander in obtaining situation awareness, making decisions and implementing decisions (McIntyre & Salas, 1995). These TDM teams gather, filter, process and communicate relevant information, often making recommendations to other team members or leaders (Cannon-Bowers, Salas, & Converse, 1993).

Research on Team Dimensions

The literature in TDM teams is a subset of team research literature. Much of recent team research involves defining distinct team dimensions or team processes (Brannick, Prince, Prince, & Salas, 1995; Fowlkes, Lane, Salas, Franz, & Oser, 1994; Johnston, Smith-Jentsch, & Cannon-Bowers, 1997; Logan, Hanson, Hedge, Bruskiewicz, & Borman, 1996; Olmstead, 1992; Orasanu, 1990; Oser, McCallum, Salas, & Morgan, 1989). All the above research except Logan et al. (1996) used training simulators to measure team dimensions or processes; the latter study used an interview technique. Table B-1 shows the team dimensions or processes identified in these studies, plus two review articles featuring composites of teamwork dimensions drawn from empirical studies (McIntyre & Salas, 1995; Cannon-Bowers, Tannenbaum, Salas, & Volpe 1995). In addition, many of these same studies demonstrated a relationship between these team processes and team outcome measures (Brannick et al., 1995; Olmstead, 1992; Orasanu, 1990; Oser et al., 1989). That is, teams that performed more behaviors indicative of effective team processes (e.g., back-up behavior) performed assigned tasks more effectively. Of these studies, only the Olmstead (1992) and Oser et al. (1989) work is with TDM teams. These two studies are reviewed in detail in Appendix C.

Research on training interventions to improve team process and outcome measures seems to fall into four areas. The first, and most frequent is training or feedback on the team dimensions (or processes) identified in the research cited above. A second is cross-training. A third is training teams to adapt to their situation and the final is the explicit training of team mental models.

Research on Training or Feedback on Team Dimensions

Several studies focus on the effects of training on team processes. Fowlkes et al. (1994) showed that air crews given

Table B-1

Dimensions of Team Behavior

Team (aircrew) processes - Brannick et al. (1995)

Assertiveness
Decision making
Adaptability
Situation awareness
Leadership
Communication

TARGETS (aircrews) - Fowlkes et al. (1994)

Mission analysis
Adaptability/flexibility
Leadership
Decision making
Assertiveness
Situation awareness
Communication

Cognitive components of decision making (aircrews) - Orasnau, 1990

Situation assessment
Metacognition (planning)
Shared mental models
Resource management

Cockpit Resource Management (aircrews) - Logan et al. (1996)

Maintaining an atmosphere facilitating teamwork
Backing each other up
Coordination
Group problem solving
Information flow

Performance measurement for team decision making training Combat Information Center (CIC) - Johnston et al. (1997)

Situation assessment
Communication
Supporting behavior
Team initiative/leadership

(table continues)

Table B-1 (Continued)

Definition of teamwork (Naval fire support teams) - Oser et al. (1989)

Communication
Cooperation
Team spirit and morale
Giving suggestions or criticism
Acceptance of suggestions or criticism
Coordination
Adaptability

Essential teamwork behaviors (Tactical decision making teams) - McIntyre and Salas (1995)

Performance monitoring
Feedback
Closed loop communication
Back-up behaviors

Teamwork skill dimensions (composite teams) - Cannon-Bowers et al. (1995)

Adaptability
Shared situational awareness
Performance monitoring and feedback
Leadership/team management
Interpersonal relations
Coordination
Communication
Decision making

Battle staff integration (battalion staff) - Olmstead (1992)

Communicating information
Decision making
Stabilizing
Communicating implementation
Coping actions
Feedback

Staff training objectives (battalion/brigade staff) - ARI/BDM (1997)

Monitor
Process
Analyze
Communicate
Coordinate
Integrate
Recommend
Disseminate
Synchronize
Direct

training including lecture, demonstration and role playing, based on the identified team skill areas (Targeted Acceptable Responses to Generated Events or Tasks [TARGET]), performed better than untrained crews in these skill areas. Leedom and Simon (1995) demonstrate that air crews given classroom discussion and simulator training based on behavioral dimensions of team coordination show improved performance on these dimensions and in mission accomplishment. Lassiter, Vaughn, Smaltz, Morgan and Salas (1990) conducted an experiment examining three types of team training. Two person teams of college students ran a scenario in an attack helicopter simulation. Before running the simulation the crews were shown one of three training videos: knowledge based training on eight team communication behaviors (i.e., lecture), demonstration (i.e., behavioral modeling) of the communication behaviors or control (i.e., two people performing a task in the simulation). The behavioral modeling tape included a description and highlighting of eight communication behaviors being modeled. Behavioral ratings of team process behaviors in the simulation showed that the crews given demonstration (behavioral modeling) training performed better on team communication than teams given knowledge based training or no training.

A study by Oser, Dwyer and Fowlkes (1995) using the TARGETs methodology demonstrated the effects of feedback on team behaviors in an inter-service (i.e., Joint) task, using distributed interactive simulation (DIS). The task involved close air support (CAS), with a team including a Marine forward air controller (FAC) in a simulated vehicle on an electronic battlefield, an Air Force ALO and Army FSO in a tactical operations center (TOC), and Air Force pilots in F-16 simulators. Observers collected behavioral ratings of the targeted team behaviors on each exercise, and provided feedback in the context of an after action review (AAR). Results showed that performance on the targeted behaviors improved over exercises.

Other studies examine the effects of training and feedback on team processes. Smith-Jentsch, Payne and Johnston (1996) describe a study where a TDM team was trained and provided behavioral feedback on the teamwork processes outlined by Johnston et al. (1997). Compared to control TDM teams not trained and provided behavioral feedback (called guided team self-correction), the trained team improved in overall performance in a TDM simulation. Also, the trained team improved over trials on specific process behaviors targeted for improvement. Team self ratings on team processes became closer to ratings of external raters (instructors) over trials. This latter finding suggests that the feedback improved the accuracy of TDM team self perceptions of team process behaviors. An experimental study of an air defense simulation using college

students by Blickensderfer, Cannon-Bowers and Salas (1997) showed that TDM teams trained in staff processes and receiving behavioral feedback improved in terms of team process performance (communication) more than did untrained teams. These TDM teams also showed greater shared expectations of team communications (how and when information is passed among the team), suggesting that training and feedback in staff processes can enhance TDM team mental models.

Research on Team Cross-Training

Volpe, Cannon-Bowers, Salas and Spector (1996) demonstrated that cross-training can improve team process, communication and performance. The authors used undergraduates to form two person air crews. Crew members were given an explanation (lecture), written instructions, demonstration and practice on either only their own crew position or both crew positions. Practice time was held constant over both cross-trained and non cross-trained crews. Cross-trained crews scored higher on ratings of teamwork process and objective measures of crew performance (e.g. number of enemy aircraft destroyed). Further, cross-trained crews volunteered more information to each other than did non cross-trained crews. This latter measure is often described as an indication of a shared mental model, in that it demonstrates that crew members intuitively understand information required by other team members.

Cannon-Bowers, Salas, Blickensderfer and Bowers (1998) replicated the value of cross-training for TDM teams. Three person teams of naval personnel participated in a TDM command and control simulation. All personnel received training and practice in at least their own position, while cross-trained teams received training and practice in all three positions. However, total training time was held constant across groups. Cross-trained teams scored higher on objective and subjective measures of inter-positional knowledge and volunteered more information than did non cross-trained teams. Under high workload (stress), cross-trained teams scored higher on objective measures of team performance than did non cross-trained teams. Also, unlike non cross-trained teams, cross-trained teams showed no degradation of team process measures under high workload.

Research on Team Adaptation

Entin, Serfaty and Deckert (1994) used a technique called team adaptation and coordination training (TACT) to improve performance of TDM teams. The authors hypothesized that high performing teams adapt to the situation. A salient component of the situation in which most TDM teams work is level of stress, defined in terms of workload and ambiguity of information. The

authors argued that teams need to alter their mutual (team) mental models and concomitant actions according to the level of stress.

Therefore, Entin et al. (1994) taught TDM teams to recognize and adapt to signs of stress. Team members were taught to recognize signs of stress in the external environment, individuals, and the team. Then they were taught five adaptive strategies to deal with the stress: preplanning, use of idle periods, use of information versus tasking communications in high stress periods, anticipation of information needs (implicit communication) and redistribution of team workload.

The teams were also given assistance in adapting their situational mental model. In one condition, called TACT+, the leader was taught to provide periodic situation updates, giving his current priorities and perception of the situation. This aids team members in filtering information; i.e., determining which information they are receiving is currently most important. This training is critical to the work of the team, since determining what information is acquired influences the entire information management process. Only information acquired can be analyzed, communicated, used in decision making, etc.

Training in TACT (or TACT+) consisted of passive instruction, demonstration, practice with the techniques and behavioral feedback on how well the techniques had been performed.

The training was successful in improving measures of teamwork, communication and team performance. Teamwork ratings, by SMEs blind to the training conditions, improved significantly from pre to post training for the TACT and TACT+ groups, but not for controls. Concerning communication, anticipation ratio (ratio of information provided to information requests) showed that team members "pushed" more information in the TACT and TACT+ than control conditions. The SME ratings of team performance again showed significant improvement for TACT and TACT+ groups from pre to post training, but not for controls. In all three areas of teamwork, communication and team performance, the TACT+ group was superior to the TACT group, but differences were not statistically significant.

<u>Research on Team Mental Models</u>

Before discussing training in mental models, a brief explanation of mental models is in order. Three major functions of mental models are description, explanation and prediction (Rouse, Cannon-Bowers & Salas, 1992). Description involves knowing the system's form (what a system looks like).

Explanation means understanding the system's function (how a system operates) and state (what the system is doing now). Prediction involves knowing a system's future state, and why the system exists.

There seem to be several types of mental models applicable to teams. Rouse et al. (1992) postulate that there are mental models of the equipment, task and team. Entin et al. (1994) state that there are situational mental models of the task environment and mutual mental models of the team.

Mental models are generally used as a concept to explain results, rather than manipulated as an independent variable (Cannon-Bowers et al. 1993). For instance, Kalisetty, Kleinman, Serfaty and Entin (1993) developed an upward anticipatory ratio that measured the ratio of information requests by superiors to information provided by subordinates. A higher ratio indicates that staffs are "pushing" information forward without waiting to be specifically asked for it, while lower ratios indicate that superiors must acquire information by "pulling" it from the staff. Results show that higher performing staffs pushed information more than lower performing staffs. The authors argue that this is an indication of better implicit understanding of information requirements or a better shared team mental model in higher performing staffs.

However, Cannon-Bowers et al. (1993) believe that training specific mental models of the task and team is possible and Stout, Cannon-Bowers and Salas (1996/1997) argue that shared mental models enhance team situational awareness, which in turn improves team outcome (performance).

In fact, Duncan et al. (1996) describe a study involving training mental models. Interviews with instructors and Combat Information Center (CIC) team members suggested six types of mental models: equipment model, task model, defense system model, ship model, team model and situation model. Observations of training revealed that the team model received the least training. An analysis of team performance errors demonstrated that the largest percentage of errors were due to team communications problems. Expert models of team communication were developed (i.e., information expected from team members and information provided to team members, as well as other sources of information available to the team).

Using this information, a computerized team model trainer (TMT) was developed. The TMT had three parts: training, simulation and feedback. It contained training on all six mental models, but the most detailed was the team model. Training on the team mental model followed the three categories of mental

model knowledge: description (what), explanation (how) and prediction (why). Under description, there was training on roles of team members, relationships among team members and temporal patterns of team performance. Under explanation, training was available on functioning of team members (how a team member performs his job), co-functioning of team members (how members perform together) and overall mechanism of team performance (how performance is accomplished). Under prediction there was training on requirements fulfilled (why the team member is needed), objectives supported (why the team is needed), and behavioral principles applicable to teams.

In the simulation mode, TDM team members could choose any position. They could choose to simply watch the scenario from that position or actually play that position. If they chose to play the position, all other positions were played by the computer. They received information and voice messages from the other positions. Team members could relate messages or request action by using pull down menus. Team members could stop and replay the scenario or portions of it at any time. In the feedback mode, members received automated feedback on their actions taken in the scenario versus actions taken by experts.

Several studies have been performed using the TMT. One showed that while individual process measures of (control) teams not receiving TMT training did not improve from pre to post test on a full team simulator, trained teams did improve on measures of individual process performance. Another showed that teams trained on the TMT improved in team process measures from pre to post test on a full team simulator. This latter study also showed that volume of team communications decreased from pre to post test for TMT trained teams, but not for control teams. Further analysis of the communications showed that the decline in communications for TMT trained teams was due to decline in number of questions asked by team members. This latter finding suggests that TMT training increased information "push" versus "pull." Finally, TMT training improved team members' knowledge of team communications (i.e., to whom in the CIC they would provide information and from whom in the CIC they would expect information). These findings suggest that training in mental models, particularly team mental models, can improve team process performance.

The authors describe the current TMT as focusing mainly on team communications skills. They state that the TMT could focus just as easily on situation assessment, team coordination, decision making or team leadership skills. These skills sound very much like the team processes or dimensions outlined in the Cannon-Bowers et al. (1995) review.

In addition to the empirical research on team training cited above, recent theoretical articles by Cannon-Bowers et al. (1995) and Stout et al. (1996/1997) discuss team training applicable to TDM teams.

Cannon-Bowers et al. (1995) define four categories of team competencies, using the two dimensions of whether the competency is or is not specific to a particular team and whether a competency is or is not specific to a particular task. Thus, a competency can be both task and team specific (context driven), only task specific (task contingent), only team specific (team contingent) or neither team nor task specific (transportable).

The authors further hypothesize that different knowledge, skill and attitude competencies are required for the four categories. Mental models of both the team and the task figure heavily in discussions of team and task knowledge competencies. Team skill competencies are defined in terms of teamwork dimensions or processes (see Table B-2). Team attitude competencies are defined as attitudes toward teamwork, team concept, collective orientation, collective efficacy, cohesion, mutual trust and shared vision.

Finally, different methods of training are required to match the different types of competencies needed. Methods of training for both task and team competencies include lecture, passive demonstration, role playing, cross-training, task simulation, and guided practice (i.e. behavioral feedback). All these methods are illustrated in the empirical research on team training discussed above.

Stout et al. (1996/1997) review studies demonstrating that better shared mental models and situational awareness are associated with better team processes and team outcomes (task performance). They argue that shared mental models enhance team situational awareness, which in turn improves team outcome (performance).

The authors then review a number of training techniques to improve shared mental models and situational awareness. These include: direct information presentation, positional knowledge training (a kind of cross-training where one learns about the tasks, responsibilities and interdependencies of team members), demonstration/modeling, concept learning (how to generalize knowledge), computer animation, task simulation, cross-training (actually performing another team member's role), guided task practice, cognitive apprenticeship (coaching), communication training (learning to use proper terminology), training in planning (e.g., time management), team leader training (e.g., how

Table B-2

Teamwork Skill Dimensions (from Cannon-Bowers et al., 1995)

Adaptability	The process by which a team is able to use information gathered from the task environment to adjust strategies through the use of compensatory behavior and reallocation of intrateam resources
Shared situational awareness	The process by which team members develop compatible models of the team's internal and external environment; includes skill in arriving at a common understanding of the situation and applying appropriate task strategies
Performance monitoring and feedback	The ability of team members to give, seek, and receive task-clarifying feedback; includes the ability to accurately monitor the performance of teammates, provide constructive feedback regarding errors, and offer advice for improving performance
Leadership/team	The ability to direct and coordinate the activities of other team members, assess team performance, assign tasks, motivate team members, plan and organize, and establish a positive atmosphere
Interpersonal relations	The ability to optimize the quality of team members' interactions through resolution of dissent, utilization of cooperative behaviors, or use of motivational reinforcing statements
Coordination	The process by which team resources, activities, and responses are organized to ensure that tasks are integrated, synchronized, and completed within established temporal constraints
Communication	The process by which information is clearly and accurately exchanged between two or more team members in the prescribed manner and with proper terminology; the ability to clarify or acknowledge the receipt of information

(table continues)

Table B-2 (Continued)

Decision making	The ability to gather and integrate information, use sound judgment , identify alternatives, select the best solution, and evaluate the consequences (in team context, emphasizes skill in pooling information and resources in support of a response choice)

to develop a positive team climate) and team self correction training (team-led feedback).

Summary of Team Dimensions or Processes

These methods of training represent the techniques of training, but for the most part, not the content. Concerning content, what to train seems to come back to team processes. Morgan, Glickman, Woodard, Blaiwes and Salas (1986) describe two distinguishable tracks of team activity: Task work and teamwork. Task work involves the operations-related activities, which for staffs includes analyzing information, making decisions, and communicating orders. Perhaps the best behavioral definition of task work processes for TMD teams is provided by Olmstead (1992). His battle staff integration processes, developed for TDM teams, are listed in Table B-3. Teamwork, on the other hand, involves interpersonal activities designed to enhance communications, social relationships and interaction patterns. Possibly the most inclusive list of team work dimensions are the team work skill dimensions of Cannon-Bowers et al. (1995), also listed in Table B-1.

A truly good TDM team training program would integrate effective team training techniques with empirically developed team processes. Thus, an effective TDM team training program would use techniques of information presentation (e.g. lecture), demonstration, role-playing, cross-training, training simulation and behavioral feedback (i.e. guided practice) to train both task work and team work team processes.

Techniques demonstrated in the above research will be seen in the discussion of current research and development in Army staff training. Some of the techniques used by these research efforts are: defining staff performance in terms of TDM team dimensions or processes; using guided self-practice in simulations to provide feedback on how well these processes were performed; and providing staff members with feedback on expert behavior in the scenario they just ran.

Table B-3

Organizational Processes (from Olmstead, 1992)

Sensing	The act of acquiring information from or concerning any environment of the organization. Includes processing and storage of information.
Communicating Information	Those activities through which information which has been sensed by some member of the organization is made available to those who must act on it or make decisions about it.
Decision Making	Deliberative activities of one or more persons leading to a conclusion that some action will, should, or should not, be taken by the organization. Usually evidenced by the initial communication of the decision by the decision maker. The communication may take the forms of announcement of the decision, a command, an order, or instructions. Decisions may lead to Active Sensing, Formal Sensing Actions, Stabilizing Actions, Coping Actions, or Feedback Actions. Decision making includes decisions to rescind decisions. Decision making is not limited to commanders, it may include all players.
Stabilizing	Actions intended to adjust internal operations, maintain internal stability or unit integrity, or prevent disruptions and negative side effects, as a consequence of coping actions. All actions intended to prevent potential negative effects to the organization which might occur because of Coping Actions, or to enhance integration.

(table continues)

Table B-3 (Continued)

Communicating Implementation	Those activities through which decisions and requirements resulting from decisions are communicated to those individuals or units who must implement the decisions. Includes: (1) transmission of orders or instruction and (2) discussion and interpretation--those communications through which clarification is achieved and implications for actions are discussed. Includes all communication links between decision maker and final implementer of decision.
Coping Actions	The process of executing actions against target environments. Primarily concerned with execution and with how actions are carried out.
Feedback	Activities that assist the organization to evaluate the effectiveness of its actions and that provide information upon which adjustments and future actions can be based.

Appendix C

Empirical Studies Linking Staff Processes and Unit Performance

Empirical research supports the proposition that battle staff competence affects unit performance. Studies in the Army and Navy show that staff competence relates to organizational performance measures.

There are at least two methods of assessing staff competence. One method, illustrated by Thompson, Pleban and Valentine (1994), is to measure staff performance on specific Mission Training Plan (MTP) tasks. Since each task is broken into numerous sub-tasks, staff competence could be measured to the sub-task level. Measuring staff sub-task performance approaches measuring specific staff behaviors. Another method is to measure the staff's competence in terms of how it performs higher level staff processes (e.g., communicate information). Generally, staffs are actually assessed on specific behaviors, but these behaviors are then grouped to represent staff processes. Studies illustrating this second method are described below.

Olmstead (1992) developed a model of seven organizational processes. These processes included sensing (acquiring information), communicating information, decision making, stabilizing (making adjustments to the organization in view of external circumstances), communicating implementation (communicating decisions and plans to those who must implement them), coping actions (executing decisions and plans) and feedback.

He then tested this model by constructing 10 battalion level staffs of 12 experienced officers each. Each staff executed a scenario via a live simulation resembling a highly scripted Command Post Exercise (CPX). All staff communication was recorded, including face to face, written and radio. One group of military experts with staff experience categorized each communication element into the appropriate organizational process. Then another military expert rated the effectiveness of each communication element on a four point scale ranging from poor to excellent. These scores were summed over all communication elements within each process to produce a total score for each process. Overall organizational (staff) competence was the total of the process scores for all process categories.

Relating organizational (staff) competence to performance requires a measure of unit performance. In order to develop a measure of performance, staffs experienced a series of probes

designed to stimulate specific actions. For example, a situation report might indicate that a subordinate unit was not where it was supposed to be according to the operations order. One group of military experts developed a list of all possible outcomes resulting from each probe. The staff might not respond to the report at all, request verification of the report, inform the unit that its position was incorrect, inform other staff members that the unit was out of position or direct the unit to the correct position. Each outcome was assigned a rating on a five point scale ranging from highly satisfactory to highly unsatisfactory. This procedure is essentially a behaviorally anchored rating scale, or BARS (Casico, 1978). An independent military expert observer matched the probe outcome produced (how the staff actually responded to the probe) to the list of possible outcomes, giving each staff response a score of one to five. The combat effectiveness (performance) score achieved by the staff was the sum of scores on all probes. There were 128 probes in all.

The measure of organizational competence (staff processes) was highly correlated with the measure of combat effectiveness (performance). The Pearson correlation between total organizational competence and effectiveness for the 10 battalion staffs was .93. Thus, staffs demonstrating more organizational competence also achieved better combat effectiveness. This finding suggests that how staffs interact and process information is related to actions that can affect the course of battle.

Keesling, Ford and Harrison (1994) also found battle staff operations correlated with unit performance at the National Training Center (NTC). They derived 37 items, measuring various aspects of staff performance, from structured interviews developed by officers at Center for Army Lessons Learned (CALL). They grouped these items into seven constructs: Staff standing operating procedures (SOP) and training, organization of tactical operations center (TOC), orders process, order quality, staff monitoring, subordinate commander's implementation, and integration. Definitions for these constructs are given in Table C-1.

After the NTC rotation, staff members rated their performance on the 37 items designed to measure these seven constructs of staff operations. Scores for these constructs were the sum of the average ratings on the relevant items for the task force commander and his primary staff.

Observer controllers also provided ratings of force on force success for NTC missions. These ratings were averaged over all missions to produce an overall force on force success rating for each unit.

Table C-1

Definitions of Staff Operations Constructs

- **Staff SOP and Training:** Standing Operating Procedures (SOP) and exercises prior to NTC.

- **Organization of TOC shifts.** Use and monitoring of staff action matrix, and TOC shifts.

- **Orders Process:** Troop leading procedures, decision making process, clarity and checking of commander's intent, and "war gaming."

- **Order Quality:** Soundness and timeliness of orders.

- **Staff Monitoring:** Staff rehearsals, tracking battles, and modifying orders.

- **Subordinate Commanders' Implementation:** Back-briefs, rehearsals, and keeping staff informed.

- **Integration:** Integration of slice representatives; obtaining, sharing, and interpreting information; and cooperation.

Statistically significant correlations were found between ratings of force on force performance and SOP/training, staff integration and orders quality (see Table C-2). Task forces having staffs with better SOPs and prior training, higher quality orders and better staff integration exhibited better force on force performance, as rated by NTC OCs. Of course, one other possible explanation for the findings is that units performing better at the NTC rated their staff functions higher, while units performing poorly at the NTC denigrated their staff functions.

The above studies linking staff processes and combat effectiveness define staff processes in terms of task work versus team work (Morgan, Glickman, Woodard, Blaiwes & Salas, 1986). Task work involves the operations-related activities, which for staffs includes analyzing information, making decisions, and communicating orders. Team work, on the other hand, involves interpersonal activities designed to enhance communications, social relationships and interaction patterns. Staff team work may also relate to combat effectiveness.

Table C-2.

Correlations Between Staff Ratings of Battle Staff Operations and OC Ratings of Force on Force Performance at NTC (Adapted from Keesling, Ford, & Harrison [1994], p. 145)

	Staff Ratings After NTC						
	SOP/ Training	TOC Operations	Orders Process	Orders Quality	Staff Monitoring	Subordinate Commander's (CDR) Implementation	Integration
OC Ratings of Force on Force Success	.71**	.14	.03	.48*	.27	.45	.70**

* Significance = .05   ** Significance = .01

N=14 Task Forces

Oser, McCallum, Salas and Morgan (1989) examined the relationship between team work-like staff behaviors and performance in a naval gunfire support environment. The Critical Team Behaviors Form was developed based on interviews at three sites with naval instructors (roughly equivalent to Army OCs at Combat Training Centers [CTC]) concerning what constitutes effective team work. The form includes 68 specific behaviors (34 positive and 34 negative) divided into seven behavioral dimensions. These dimensions were communication, cooperation, team spirit and morale, giving suggestions and criticism, accepting suggestions and criticism, coordination and adaptability.

Observers collected data on teamwork and staff performance in a simulated naval gunfire exercise. Observers monitored 13 staffs during four day simulation exercises and recorded the frequency with which specific behaviors on these dimensions occurred. On the fifth day observers evaluated staffs' performance in a standard (i.e., scripted) simulation exercise, on a standardized scoring protocol (the same for all staffs), with a maximum of 100 points possible. Although this exercise was conducted in a simulator, it appears to be a valid measure of combat effectiveness. Performance scores in this simulation were significantly correlated with later performance of the same staffs in live fire exercises.

Results of the simulation exercise demonstrated a relationship between team work behaviors exhibited by the staff and measures of combat effectiveness. Data demonstrated that the frequency with which staff members performed certain teamwork behaviors related to simulation performance. Each behavior was coded as 1, 2 or 3, depending on the frequency with which it occurred during the four days in which observers recorded staff behaviors. Behaviors occurring three to eight times were coded as 3, those occurring one or two times as 2 and those not occurring at all were coded as 1. Ten behaviors, listed in Table C-3, were found to correlate significantly with final exercise score. These items involved monitoring other's performance, providing feedback, verifying communications and backing each other up.

Similar findings were also obtained in naval antisubmarine warfare and guided missile training (McIntyre & Salas, 1995). In addition, effective staffs saw themselves as interdependent, fostered that interdependence (i.e., depended on each other's performance), exhibited flexibility (altering behavior as the situation dictates) and developed over time.

Table C-3

Significant Correlations of Behavior Frequencies with Final Exercise Scores (Adapted from Oser, McCallum, Salas, & Morgan, 1989, p. 24)

Behavior	Correlation*
Helped another member who was having difficulty with a task.	.67
Made positive statements to motivate the team.	.54
Assisted another member when the latter had a difficult task to perform.	.49
Praised another member for doing well on a task.	.59
Made negative comment about the team or training. (I)	-.70
Suggested to another that he recheck his work so that he could find his own mistake.	.54
Raised his voice when correcting another member. (I)	-.60
Thanked another member for catching his mistake.	.60
Coordinated gathering of information in an effective manner.	.50
Provided suggestions on the best way to locate an error.	.49

* = $p<.05$, 1-tailed test
I = Ineffective behaviors, the remainder were effective behaviors